THE
AMERICAN JOURNAL OF MEDICAL TECHNOLOGY

EDITOR-IN-CHIEF

Rose Matthaei
M.T. (ASCP)
Suite 25, Hermann
Professional Bldg.
Houston 25, Texas

EDITORIAL STAFF

ADVISORY EDITORS

Frieda Claussen
M.T. (ASCP)
St. Paul, Minnesota

Mrs. Doris Whitney
M.T. (ASCP)
Roselle, Illinois

ASSOCIATE EDITORS

Evelyn Ballou
M.T. (ASCP)
Washington, D.C.

Mary Benedict Clark
M.T. (ASCP)
Louisville, Kentucky

Elsbeth Ellis
M.T. (ASCP)
Miami Beach, Florida

Esther Freier
M.T. (ASCP)
Minneapolis 11, Minnesota

Leanor D. Haley
Ph.D. M.T. (ASCP)
New Haven
Connecticut

Mrs. Elsa Kumke
M.T. (ASCP)
Detroit, Michigan

Patricia Sallas
M.T. (ASCP)
New Orleans, La.

Sister M.
Simeonette Savage
Spec. Bact. (ASCP)
Louisville, Kentucky

Angela Serafini
M.T. (ASCP)
Detroit, Michigan

Genevieve Stout
M.T. (ASCP)
Chamblee, Georgia

The publishers accept no responsibility for opinions expressed by contributors.

CONTENTS

VOLUME TWENTY-ONE NUMBER 4
JULY-AUGUST
1955

Page

Cross Matching the Uncrossmatchable
by Jane F. Taylor, M.S., MT (ASCP).....193

Some Aspects of Medical Technology in Canada and in the United States
by Evelyn Brownridge Hunt, R. T. (Canada), B.A., B.S., MT (ASCP).....198

Broader Horizons in Medical Technology
by Philip R. Rezek, M.D......204

From Our Readers.....212

Demonstration of Anti-Kell by Routine Blood Bank Procedures
by Edith L. Bossom, A.B., MT (ASCP).....213

The Role of a Registered Medical Technologist In a Physician's Office
by Mattie Sue Detro, MT (ASCP).....217

An Introduction to the Thromboplastin Generation Test
by Doris M. Dede, A.B., MT (ASCP).....222

Urinalysis—A Survey of Current Practices
by Marion H. Cook, B.S., MT (ASCP).....232

The Gavel 243

Among the New Books.....243

Announcement 243

Convention Awards (1955).....244

The American Journal of Medical Technology is owned by The American Society of Medical Technologists. It is published bi-monthly. The volume begins with the January issue.

American Society of Medical Technologists

BOARD OF DIRECTORS

President: Barbara Isbell, 3725 Oleander Drive, San Diego 6, California
President-elect: C. Patton Steele, Box 1020, Bismarck, North Dakota
Treasurer: Mrs. Kathryn Dean, 1312 Silverthorne Road, Baltimore 12, Maryland
Secretary: Ellen Anderson, Pathology Dept., Med. School, Univ. of North Carolina, Chapel Hill, North Carolina
Ruth Heinemann, 3436 - 47th Ave. South, Minneapolis, Minnesota
Sister Mary Simeonette (Savage), 851 South Fourth St., Louisville, Kentucky
Mrs. Elsa Kumke, 7726 East Jefferson, Detroit 14, Michigan
Anna Bell Ham, 1190 South Alhambra Circle, Coral Gables, Florida
Leanor Haley, Ph.D., 310 Cedar Street, New Haven, Connecticut
Rose Hackman, 842 Garfield Street, Denver, Colorado
Ruth Hovde, 515 Delaware Ave., S. E., Apt. 202, Minneapolis, Minnesota

ADVISORY COUNCIL OFFICERS

Chmn.: Jeanne Magnani, 6400 Elliott Place, Hampshire Knolls, Hyattsville, Md.
Vice Chairman: Emily E. McAdory, 220 Deadrick Street, Bessemer, Alabama
Recording Secretary: Ruth Feucht, 429 No. Lombard, Oak Park, Illinois
Asst. Recording Secretary: Sister Ann Marie Skinner, St. John's Hosp., 307 S. Euclid, St. Louis 10, Missouri
Corresponding Secretary: Joyce Wagner, 7017 Cedar Street, Wauwatosa 13, Wisc.

EXECUTIVE SECRETARY

Ruth Matthaei, Suite 25, Hermann Professional Building, Houston 25, Texas

COMMITTEE CHAIRMEN

Finance: Anna Wassell, 1644 Northbourne Road, Baltimore 12, Maryland
Public Relations: Elizabeth O'Connor, 2203 Ridge Avenue, Evanston, Illinois
Education: Mrs. Jacqueline Bahrenburg, St. Luke's Hospital, Spokane, Washington
Standard and Studies Committee: Thelma Wilson, #4 Fairview Apts., South St., Bluefield, West Virginia
Membership Committee: Nila Maze, 6106 Carvel, Apt. C-3, Indianapolis 20, Indiana
Legislation: Lucille Larson, Tacoma General Hospital, Tacoma, Washington
Constitution & By-Laws: Marian Anderson, 1765 Laurel Avenue, St. Paul 4, Minn.
Recruitment: Audrey Murphy, 5444 Queens Avenue, St. Louis 15, Missouri
Research: Henrietta Lyle, Washington County Hospital, Hagerstown, Maryland
Nominations: Genevieve Stout, V. D. Research Lab., Box 285, Chamblee, Georgia
Civil Service-Armed Services: Ruth Heinemann, 3436-47th St. South Minneapolis 6, Minnesota
Insurance: Mrs. Elsa Kumke, 7726 East Jefferson, Detroit 14, Michigan

AFFILIATED SOCIETY PRESIDENTS

William M. DeLoach, Cloverdale Gr., Tuscaloosa, Alabama
Mr. Harry N. Long, 2827 West Montebello, Phoenix, Arizona
Lila L. Church, 2116 Orange Street, No. Little Rock, Arkansas
Clara Brodsky, 340 Norwich, Los Angeles 48, California.
Lois Casperson, 2 East Boulder, Colorado Springs, Colorado
Carl Ritter, 20 Pearl Hill St., Milford, Connecticut
Vinna S. Ferrell, 1212 Delaware Avenue, Wilmington, Delaware
Jeanne Magnani, 6400 Elliott Place, Hyattsville, Maryland, (District of Columbia)
Philip G. Cash, 2535 1st Avenue N., St. Petersburg, Florida
Willard Jurney, Gready Memorial Hospital, Atlanta, Georgia
Lydia Martens, c/o Children's Hospital, Honolulu, Hawaii
Claire Lyons, Box 728, Caldwell, Idaho
Ruth Feucht, 427 No. Lombard, Oak Park, Illinois
Martha Winstead, 111 W. Bartlett, South Bend, Indiana
Clarence Grosz, 1642 37th, Des Moines, Iowa
Virginia Hocker, 132 North Knox, Topeka, Kansas
Ruth Robinette, 3004 Bath Avenue, Ashland, Kentucky
Anna Persich, 2011 Perdido St., New Orleans, La.
Marilyn Sherman, North Scarboro, Maine
Sr. Paula Marie Phelan, R. S. M. Mercy Hospital, Baltimore, Maryland
Mrs. Helen Wiot, 39 Davis Street, Wollaston 70, Massachusetts
Mrs. Mary McPhee Scott, 13587 Monte Vista, Detroit 38, Michigan
Verna Rausch, 5609 Fremont Street, Minneapolis, Minnesota
Alida M. Bos, 333 Illinois Avenue, Vicksburg, Mississippi
Helen Alig Dawes, 7222 Charlotte, Kansas City, Missouri
Catherine Reid, 1514 2nd Avenue North, Great Falls, Montana
Dorothy E. Jahn, 800 South 13th St., Lincoln, Nebraska
Mrs. Julie Waller, 1155 Jones St., Reno, Nevada
Robert P. Grovenstein, RFD #1, Rochester, New Hampshire
Mrs. Catherine Milos, 631 Ridgewood Road, Oradell, New Jersey
Sylvia Saarnijoki, 310 Marshall St., Syracuse 10, New York
Mary Elizabeth Motsinger, 2428 South Main Street, Winston-Salem, North Carolina
Mrs. Margaret H. Saumur, Path. Dept., Univ. of N. D., Grand Forks, North Dakota
Genevieve Goodwin, 125 Prospect St., Dover, Ohio
Billie Scarbrough, 601 E. Broadway, Cushing, Oklahoma
Mary Elizabeth Baptist, 211 North West 21st Ave., Portland, Oregon
Romayne A. Teufel, 1167 Pemberton St., Pittsburgh 12, Pennsylvania
Mary Eileen Leonard, 907 Rutledge Avenue, Charleston, South Carolina
Sister Mary Vincentia, St. John's Hospital, Huron, South Dakota
Deane Brown, 1151 Eleanor St., Knoxville, Tennessee
Ruth Morris, Box 1719, Ft. Worth, Texas
Colleen Hamilton, 1125 Alpine Place, Salt Lake City 5, Utah
Alice Laughlin, Nutrition Research Dept. Medical College, Univ. of Vermont, Burlington, Vermont
Rosemary Henretty, Johnston Memorial, Abingdon, Virginia
Warren P. Brown, Good Samaritan Hospital, Puyallup, Washington
Mrs. Marjorie Plymale, 1439 Sixth Avenue, Huntington, West Virginia
Joyce Wagner, 7017 Cedar Street, Wauwatosa, Wisconsin
Dorothy Thomas, 418 W. 19th St., Cheyenne, Wyoming

The
AMERICAN JOURNAL
of
MEDICAL TECHNOLOGY

VOLUME 21 JULY-AUGUST NUMBER 4

CROSS MATCHING THE UNCROSSMATCHABLE RECIPIENT*

JANE F. TAYLOR, MS, M.T. (A.S.C.P.)
The Children's Hospital, Columbus, Ohio

The most common reason for uncrossmatchable blood is the presence in the serum of the recipient of a strong cold agglutinin active at room temperatures. The incompatibility is usually found on the major side (recipient's serum vs. donor cells) and occasionally on the minor side of the cross match. This trouble may occur whether the cross match is performed using red cells in a saline suspension, or using packed unwashed red cells without saline, (the so-called "serum cross match"). When confronted with an incompatible cross match, the technologist, after rechecking the types of recipient and donor, usually attempts to cross match a number of donors to find one that is compatable. This is of little use, since the blood of a recipient having a cold agglutinin active at room temperature will seldom be compatible with the blood of any donor. The nature of this incompatability is revealed when the patient's serum and cells are put together. This accomplishes two things: first, it assures one that the cell suspension of the donor does not contain clumps which might be misread as agglutination; and secondly, it demonstrates that the patient's serum has strong agglutination powers against his own cells, hence it is uncrossmatchable.

When partial agglutination occurs, further confirmation of the presence of cold agglutinins is obtained by warming the agglutination tube to 37°C. for a few minutes, centrifuging it immediately and reading for agglutination while still warm. The agglutination will be less than it was at room temperature. If the same tube is placed in ice water a few minutes, centrifuged, and read while still cold, the agglutination will be strengthened. These features, agglutination of the patient's cells by his own serum, diminution of agglutination in the warm, strengthening of agglutination in the cold are characteristics of cold agglutinins,

* First A.S.M.T. Convention Award Paper. Read June 1955, New Orleans, Louisiana.

even though the original phenomenon may have been observed at room temperature.[1, 2] It is obvious that only rare individuals have this property. Its possession does not mean that the person cannot be transfused successfully.

Unless proven otherwise, one cannot be assured that a cold agglutinin does not mask a real blood group incompatability. In attempts to cross match the patient the procedure to be followed is removal of the cold agglutinin without removal of a possible immune blood group antibody. This is accomplished by absorbing the cold agglutinin onto red cells when chilled and eluting it from these red cells into the suspending fluid, when warmed. Immune antibodies are not removed by this procedure when the patient's own red cells are used.

Occasionally a cold agglutinin will be so strong that, even at room temperature, it will coat the cells of the patient to such an extent that it is impossible to secure a correct type. This is especially true with some Rh typing sera which contain a high protein concentration. Therefore all patients having a cold agglutinin active at room temperature are retyped after removal of cold agglutinins from the cells and before the cross match is performed with the cold-agglutinin-free blood.

Procedure for Removal of Cold Agglutinins

Secure a fresh sample of blood from the recipient, half of this should be oxalated and half clotted. Allow these specimens to stand for 15 to 30 minutes, the oxalated one at 37°C. and the clotted one at 4°C. Centrifuge the specimens, save the cells from the oxalated sample and the serum from the clotted specimen.

STEP I

Mix the cells with at least 3 volumes of warm saline, allow to stand 15 minutes at 37°C., centrifuge, remove and discard all saline.

STEP II

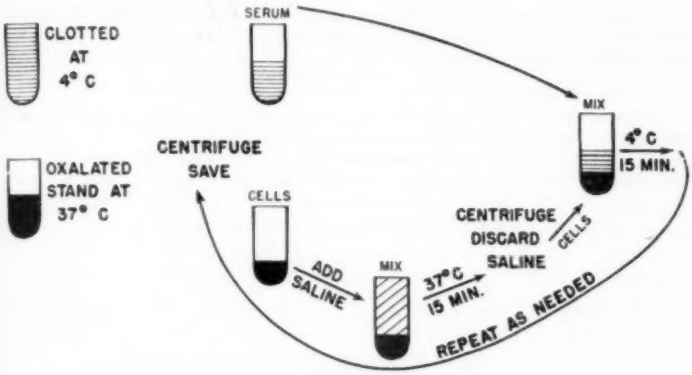
The process of clotting in the cold may be sufficient to remove a cold agglutinin only weakly active at room temperature. To test for removal of cold agglutinins, place 2 drops of the serum in a tube, add enough of the cells for a macroscopic reading, centrifuge, read for agglutination both macroscopically and microscopically. Then warm the tube to 37°C. for a few minutes, recentrifuge, and, while still warm, check for agglutination. If this procedure has not removed the cold agglutinin to the extent that it gives only a trace of a reaction at room temperature and none at 37°C. then the following steps must be taken.

STEP III

Add the serum previously saved to an approximately equal volume of the cells from Step I, and allow the tube to stand in ice water for 15 minutes. Centrifuge, separate serum and cells,

save both. Mix the cells with warm saline, repeat Steps I and II.

This whole cycle is repeated as often as necessary until the cells and serum put together, as in Step II, give a minimum of agglutination at room temperature and none at 37°C. Save both the serum and washed cells for the cross match. The procedure is graphically represented in Figure I.



REMOVAL OF COLD AGGLUTININS FROM SERUM AND CELLS OF A RECIPIENT

Fig. I

Procedure for Cross Matching

Having secured cold-agglutinin-free serum and cells, the patient is retyped and blood from a donor with the corresponding blood groups is chosen. The indirect Coombs crossmatch should be used so that if there is an immune type of antibody in the patient's serum, it will not be overlooked. Three tubes are used for the cross match, the first contains recipient's cold-agglutinin-free serum and donor's warm washed cells (all saline removed), the second, the donor's serum and the recipient's cold-agglutinin-free cells, the third, the recipient's cold-agglutinin-free cells and serum to serve as a control. All three tubes are incubated at 37°C. for thirty minutes, centrifuged, and checked at all three temperatures for agglutination. The cells in all three tubes are then washed three times with warm saline, anti-human globulin serum (Coombs) added, the tubes incubated at 37°C. for 15 minutes, centrifuged and read while warm for agglutination. A sample protocol is given in Figure II.

SAMPLE PROTOCOL FOR CROSS MATCHING RECIPIENT WITH COLD AGGLUTININS

	4° C	20° C	37° C
RECIPIENT'S SERUM + RECIPIENT'S CELLS=	++++	++++	++
PROCEDURE FOR REMOVAL OF COLD AGGLUTININS REPEATED UNTIL:			
RECIPIENT'S SERUM + RECIPIENT'S CELLS=	+++	±	–
COMPATIBLE CROSS MATCH USING COLD AGGLUTININ-FREE CELLS & SERUM.			
RECIPIENT'S SERUM + COMPATIBLE DONOR'S CELLS=	+++	±	–
RECIPIENT'S SERUM + COMPATIBLE DONOR'S CELLS (+ COOMB'S SERUM)=			–
INCOMPATIBLE CROSS MATCH USING COLD AGGLUTININ-FREE CELLS & SERUM.			
RECIPIENT'S SERUM + INCOMPATIBLE DONOR'S CELLS [A OR B INCOMPATIBILITY]=	++++	++++	+++
RECIPIENT'S SERUM + INCOMPATIBLE DONOR'S CELLS (+ COOMB'S SERUM)=			+++
[IMMUNE INCOMPATIBILITY SUCH AS RH, ETC.]			

Fig. 2

At this point a word of caution is in order concerning certain types of patients that should not be treated by this procedure. Certain cases of hemolytic anemia have been reported in which the patients have developed immune antibodies against specific Rh components of his own cells.[3-4] Such patients can be detected by means of a positive direct Coombs test performed after warm saline has been used to wash the cells thoroughly. The detection and identification of the antibody involved requires elution of the antibody and testing for specificity of the antibody in the eluate after the manner of Dacie or van Loghem. In these extremely rare cases, use of the patients' own red cells to absorb the cold agglutinins might also result in removing the immune antibody.

In the past year we have had five patients from our hospital and two referred from another hospital who were impossible to cross match using the routine methods. By applying this procedure for removing cold agglutinins we were able to cross match these patients for repeated transfusions. The most stubborn case of cold agglutinins required repeating the cold-warm treatment twelve times before the cold agglutinins were removed so that the patient could be typed and cross matched. One case required that the cold-warm procedure be repeated six times; in two cases the treatment was repeated three times; and in three cases allowing the blood to clot in the refrigerator and washing the cells several times in warm saline was sufficient to remove the cold agglutinins. In all six cases the patients were repeatedly transfused with no reaction.

Summary

Most uncrossmatchable blood is due to the presence in the serum of the recipient of a cold agglutinin which is active at room temperature. A cold agglutinin can be identified by a serum cross match performed at room temperature, 37°C. and 4°C. using the recipient's own serum and cells. Agglutination will be diminished at 37°C. and strengthened at 4°C. The blood is made crossmatchable by removing the cold agglutinin from the recipient's serum and cells. The recipient's cells are used to absorb the cold agglutinin from the serum in the cold. The agglutinins are eluted from the cells into warm saline and discarded. Immune antibody, if present, will not be removed by this procedure. When the cold agglutinin has been removed, the blood can be correctly typed and then successfully cross matched, even by the indirect Coombs technic, performing all steps at 37°C. The indirect Coombs cross match is used to protect against the presence of an immune blood group antibody. Seven patients who were uncrossmatchable by the routine serum cross match were successfully cross matched and repeatedly transfused when cold agglutinins were removed from their sera using this procedure.

REFERENCES

1. Kabat, E. A., and Mayer, M. M.: **Experimental Immunochemistry,** Charles C. Thomas, 1948, page 94.
2. Stalt, D., and Wasserman, L. R.: Medicine 1943, 22:363.
3. Dacie, J. V., Cutbush, M., Specifity of Auto-Antibodies in Acquired Haemolytic Anaemia, *J. Clin. Path.*, 1954, 7:16-21.
4. Loghem, J. J. van, Hart, M. van der, Varieties of Specific Auto-Antibodies in Acquired Haemolytic Anaemia, I and II Vox Sanguinis, 1954, 4:2-11, 129-134.

SOME ASPECTS OF MEDICAL TECHNOLOGY IN CANADA AND IN THE UNITED STATES

EVELYN BROWNRIDGE HUNT, B.A., B.S., M.T. (ASCP), R.T. (Canada)
St. Mary's Hospital, Duluth, Minnesota

The purpose of this paper is to acquaint the medical technologists in the United States with the Canadian Society and its members whose aims, work, problems and hopes are so very much alike.

Our profession, young in years as it is here in the United States, is younger still in Canada. In the year 1937, the Canadian Society of Laboratory Technologists, incorporated under federal charter, and later under agreement with the Canadian Medical Association, became the official Registry of Medical Technologists throughout Canada. In the United States the Registry of Medical Technologists was established in 1928 by the American Society of Clinical Pathologists. Both the Canadian and the American Registry have won the recognition of the Canadian and American Medical Associations, the Canadian and American Hospital Associations, the Catholic Hospital Association, and of countless pathologists, physicians and hospital administrators. Thus the Registry in each country is universally accepted as the authoritative organization for the qualifying of medical technologists.

Medical technologists are governed by a Code of Ethics, and this Code is similar in both countries as the following indicates.

American Code of Ethics

1. Nothing in this code of ethics shall be inconsistent with that of the A.S.C.P. and that of the A.M.A.
2. I will at all times work only under the direction and supervision of a pathologist or duly qualified doctor of medicine or specialist in one of the divisions of clinical pathology, such qualifications being determined on the basis of accepted medical ethics.
3. I will make no diagnosis or interpretations other than those in the reports prepared by me.
4. I will not advise physicians or others how to treat disease.
5. I will not accept technical work from any other source than from

Canadian Code of Ethics

1. The medical technologist shall look upon the profession of medical technology as one dedicated to the service of humanity; the medical technologist shall regard the welfare of the patient as of the highest importance, remembering that decisions of great importance may depend upon the accuracy of any report rendered.
2. The medical technologist shall work at all times under the supervision or direction of a pathologist or a qualified physician.
3. The medical technologist shall consider all laboratory work on patients as confidential information to be communicated only to the physician or to persons designated by the physician.

* Read before ASMT convention, June, 1954, Miami Beach, Florida.

my employers' practice.
6. I will not train students without the supervision of a clinical pathologist.
7. I will not engage in laboratory work independent of qualified supervision (as provided in section 2) nor will I operate an independent laboratory.
8. It is ethical to perform laboratory work on a commission basis under contract with a public health, research or clinical laboratory when such work is done as provided in section 2 above, and when all contractual agreements are approved and signed by the director of the organization contracting for such services.

4. The medical technologist shall understand that the interpretation of laboratory reports and the diagnosis of disease are the responsibility of the physician, not of the medical technologist.
5. The medical technologist should not advise physicians or others regarding the treatment of disease.
6. If a medical technologist is requested to give special treatment, such as intravenous injections, it should be done only upon the direction or under the supervision of the attending physician.
7. The teaching of medical technology to students without the supervision of a qualified medical director is contrary to the spirit and purpose of this Code.
8. Medical technologists shall endeavor to uphold and maintain the dignity and respect of their profession; medical technologists shall consider reliability, courtesy, patience, tact, efficiency and personal integrity as fundamental attributes of a good medical technologist.
9. Medical technologists shall be loyal to their colleagues and shall recognize an obligation to support professional organizations by interest and active participation insofar as it is possible.
10. Medical technologists shall continually improve their skill and extend their knowledge by all means available and shall endeavor to keep in touch with technical advances in the field of medical technology.

The titles of the registrants necessarily differ. In the United States one who has met the Registry Requirements and who has passed the examination for registration may affix the letters M.T. (A.S.C.P.) after his name. The proper Canadian counterpart is R.T. (Canada), R.T. standing for the words Registered Technologist. Examinations for general certification are given semi-annually both in Canada and in the United States. The examinations differ in type. The Canadian examination is a subjective one, while the American examination is an objective, multiple-choice type. Just a word or two at this time to consider the subject matter required to be learned for general certification. I have studied at some length the Syllabus of Studies pub-

lished by the Canadian Registry and used as a guide in Canadian training programs, and Dr. Israel Davidsohn's Curriculum for Schools of Medical Technology which is recommended by the American Board of Registry for use in the American training program. It is my impression that the training programs in each country are very comparable on a general certificate level.

Lists of approved schools for medical technologists are available to interested persons from each Registry office. Headquarters of the Canadian Registry is the Canadian Society of Laboratory Technologists which has its executive office in Hamilton, Ontario, Canada. Muncie, Indiana, USA is the home of the American Registry of Medical Technologists of the American Society of Clinical Pathologists. American schools of medical technologists are approved by the Council on Medical Education and Hospitals of the American Medical Association. This council inspects, reports and approves the schools; the Board of Registry investigates and certifies the competency of the medical technologists. Canadian schools for medical laboratory technologists are approved by a Committee of pathologists appointed by the Canadian Medical Association. This Committee, which is a representative part of the Canadian Association of Pathologists, also inspects, reports and approves the schools for training in Canada. The technologist is subsequently certified by the examinations of the Canadian Society of Laboratory Technologists as a qualified, registered technologist.

Each Registry has different types of certification according to the fulfillment of pre-clinical and technical requirements. These are:

Pre-Clinical Requisites:

American Registry

1. Medical Technologist

a) Graduation from an accredited high school or equivalent.

b) Two years (60 semester hours) of a four year degree course in any college or university recognized by an accredited standardizing association. During the two years the following courses must be taken: *Biology:* 18 quarter hours or 12 semester hours which may include general biology, bacteriology, parasitology, anatomy, histology, zoology, embryology or physiology. Bacteriology is especially recommended. *Chemistry:* 9 quarter hours or 6 semester hours of inorganic chemistry including lectures and laboratory, and 4 quarter hours or 3 semester hours of either quantitative analysis, organic chemistry or

Canadian Registry

1. General Certificate

Senior matriculation or the equivalent educational standing in the various provinces; standing must include two sciences, namely, chemistry and physics or biology and two electives of the following courses in mathematics-algebra, geometry or trigonometry. The Department of Education in each province has in addition other specific requirements which must be fulfilled in order to obtain senior matriculation standing in that Province.

Senior matriculation, while differing slightly in specific subject content in the different provinces is equivalent to university entrance into any *three* year degree course in a Canadian University.

biochemistry including lectures and laboratory. Quantitative analysis is especially recommended.
Electives: sufficient to give a total of 90 quarter hours or 60 semester hours of college credit. Following highly recommended, but not required: physics, typing, general mathematics.

2. Specialist Certification:
Master's degree or doctorate in the specialty.
Three years of experience in the specialty in a medical laboratory.

2. Specialist Certification:
General Certificate and 2 years experience in the special field.
or
University degree in biological sciences (accredited university) and two years experience in special field exclusive of undergraduate studies.
or
Senior matriculation with the necessary pre-requisites and at least five years experience in the special field.
Specialist certificates are offered in Biochemistry, Haematology, Blood Bank, and Histology.
Examination for specialist certification is offered only in the Spring of each year. Only one examination may be taken in any one year.

Clinical Training:

Both the Canadian and the American Registry require a minimum of twelve consecutive months of training in an approved school of medical technology. Although many schools both in Canada and in the United States require, of their own volition a longer period of clinical training, (and/or pre-clinical training), the requirements are as yet the official minimum. Having fulfilled these requirements the medical technologist is certified and privileged to practice medical laboratory technique.

Should the technologist wish to specialize in one particular field of medical technology, he may do so. Specialist certification in Canada is available as indicated above. In the United States persons who have graduate degrees may, if they desire, become certified as specialists with the American Registry as indicated above. In addition, the American Registry provides limited Certificates in Chemistry, Bacteriology and Histologic Technique, upon completion of certain requirements, as well as the category Laboratory Aides.*

Both the Canadian and the American Registry require an official transcript of credits to accompany all applications for certification.

Medical technologists in Canada and in the United States are privileged to have professional organizations for active members. The American Society of Medical Technologists with its executive office in Houston, Texas, is the official organization for American technologists. It is independent of the Registry in Muncie but Registry certification is one of the requisites for membership. Unfortunately many registrants do not avail themselves of the opportunity to work for their professional advance-

* This category is now discontinued.

ment through their professional organization.

The Canadian Society of Laboratory Technologists and that Registry are one and the same entity. To be a member of one is to be a member of the other. Thus the Canadian Society of Laboratory Technologists is not only the professional organization for laboratory technologists, but it is the board of standards for the profession as well.

Journals are published by both the Canadian and the American Societies. In addition the American Registry publishes a monthly Technical Bulletin. "The Canadian Journal of Medical Technology" is published quarterly and is sent to all members of the organization. "The American Journal of Medical Technology" is published bi-monthly. In both countries newsletters are sent at intervals to the active membership.

Any organization must have capital on which to operate. Thus the necessary dues. Active members of the Canadian Society must pay twelve dollars a year. Active members of the American Society must pay eight dollars a year and their state society dues. In addition the American Registry requires two and one-half dollars for the annual renewal of registration.

Both Societies hold annual conventions in sites which rotate annually between Eastern and Western cities in Canada, and Eastern and Western, Northern and Southern cities in the United States. We all anticipate with much pleasure the first International Convention which will be sponsored by the American and Canadian Societies which is being planned for 1956 and is to be held in the Canadian city of Quebec, P. Q.

Reciprocity between the Registries and Societies of our two countries is being studied now both in Canada and in the United States. Mutual understanding of each group by the others will do much to bring about a sound approach to a solution which will be to the future benefit of the medical technologists and laboratory services in both of our lands.

I have tried to acquaint you by parallel study with the pre-technical, and some of the technical requirements for registration as a medical technologist in Canada and in the United States, and with the professional organizations which are so vitally important to all of us who are medical technologists, wherever we dwell.

BIBLIOGRAPHY

1. Registry of Medical Technologists of the American Society of Clinical Pathologists, 1 July, 1952, 17th edition, 17th printing.
2. By-Laws of the Canadian Society of Laboratory Technologists, Revised 1951.
3. Articles of Incorporation and By-Laws of the American Society of Medical Technologists.
4. Approved Schools for Medical Technologists, to May, 1952.
5. Approved Schools for Laboratory Technologists, Published by the C. S. L. T.

6. The Canadian Society of Laboratory Technologists Membership Roster, 1953.
7. Syllabus of Studies of the Canadian Society of Laboratory Technologists, Revised January, 1953.
8. Information Pamphlet, American Society of Medical Technologists, Sept., 1949, 5th Edition.
9. Canadian Journal of Medical Technology, Volume 14, Number 2.
10. Curriculum for Schools of Medical Technology, Israel Davidsohn, M.D., 1942.

The preceding article will serve as an introduction to our Canadian Co-workers, with whom we shall meet in joint Convention

JUNE 17-22, 1956

at the Chateau Frontenac,

in Quebec City, Quebec, Canada, for the FIRST NORTH AMERICAN CONFERENCE OF MEDICAL LABORATORY TECHNOLOGISTS

Conference Theme: Service through cooperation.

BROADER HORIZONS IN MEDICAL TECHNOLOGY†

PHILIP R. REZEK, M.D.

The invitation to give a talk before this outstanding assembly on broader horizons in medical technology is an honor, but also a challenge. Whether I deserve this honor I cannot decide, but I am extremely happy about the challenge.

It is appropriate to look to the past before contemplating the broad horizons which mean the future. Heading the laboratories of the Jackson Memorial Hospital for 15 years, I had not only the good fortune to watch their development, but was also able to witness the growth of pathology and clinical pathology in this period of time. The fields in question became so vast and wide that the single pathologist has to ask hmiself the honest question whether he individually, is able to cope and to keep up with the different branches of these fields. If he is also scientifically minded and interested in research he has to combine his routine duties with his scientific interest. With the growing demands on the laboratories in an institution like ours, the daily routine increases the aforementioned burdens. It is therefore well understandable that the educational branch of the A. M. A. leaves it up to the individual pathologist to decide whether he will specialize in pathologic anatomy only, in clinical pathology only, or in both. But even if he does the latter, at the bottom of his heart, he will always be inclined to prefer one field or the other.

Similar observations can be made in the field of medical technology. For me it was very illuminating to watch how many of my co-workers in the laboratory realized that it became impossible to do a perfect job in bateriology and biochemistry e.g., especially if the institution and with it the laboratory expands rapidly. This realization led to the organization of different departments, headed by individual technologists who were especially interested in these particular fields. And from there on it was only a short climb to reach a higher level in the field and to obtain a degree. These last 15 years were hard work and the job could never have been done without such loyal and interested co-workers. I would not know a better place to thank them for their help than in front of this assembly composed of their own colleagues. I am sure you will not mind if I express these thanks to the following members of our laboratories: Mrs. Maxine Ace* who has been with us since 1939, Mrs. Adele Mason* since 1942, Mrs. Margaret Lewis* since 1943, Mrs. Anna Louise Rundell* since 1943 and Dr.

* Laboratory assistants.

† Read before ASMT, June, 1954, Miami Beach, Fla.

Alexander Kimmler since 1948. In spite of a tremendous overload of work, Dr. Kimmler* was able, while working in our laboratory, to obtain a Ph.D. in bacteriology and Mrs. Rundell a master's degree in biochemistry. Miss Audrey Fjelde* who was with us since 1938 and left in 1947 was responsible for the inauguration and recognition of the school of medical technology; during this time she obtained a master's degree and later, after leaving us, she received her Ph.D. in bacteriology. I assure you I would not be able to address this audience today if all of them had not gone along with me so devotedly.

I wonder whether you have realized that mentioning these activities very briefly, I omitted one branch of medical technology which, though important, has to be considered a stepchild. I mean histological technique. Bacteriology, biochemistry, hematology have done so much to raise the interest of the individual scientifically minded technologist, while histology apparently has no attraction. Is this really justified? True, histology or histopathology belong to the so-called morphological sciences, so despised in the last years on account of their dryness which, I can assure you, does not exist. How dull it is to cut, to stain, and to look through a microscope to describe cells, you often hear. Nobody denies the importance of such a diagnosis, but what is important is not always fascinating. My following remarks have the purpose to disperse these opinions.

True, histology is a part of morphology or better it is partly morphology, but histology does not end with description, especially if one realizes that it is function which determines the form largely and not vice versa. In other words, the histologist as well as the histological technician have to deal not only with form (morphos) but also with function. It is therefore appropriate to speak of cytology with the mental reservation of cytobiology, especially if we consider the single cells instead of the pattern. As a matter of fact, today cytology is considered nothing but a branch of biology and as such, following the outline of Robertis, Nowinski & Saez, it has shown rapid progress and has been converted into the fundamental basis for study of structure and function of living organisms, in normal and pathological conditions. And with biology, chemistry entered the field of histology and its technique with a tremendous impact. To quote Pearse, histochemistry can transform the descriptive sciences of biology, histology, pathology and zoology into dynamic and functional sciences complimentary to physiology and biochemistry. There is no histochemistry without chemistry and no understanding of the methods without knowledge of their chemical background. In its morphological aspects, cytology has gone beyond simple description of structures visible

in the light microscope and the recent advances in nuclear physics bestowed on us the electron microscope which permits us to study the architectural arrangements of the molecules and micelles, composing living matter. In their functional aspect, we are not satisfied anymore to *describe* physiological changes, but we ask for explanation of these changes, to get an insight into the physio-chemical and metabolical processes of protoplasm. All these endeavours may explain the phenomenon of heredity, sex, variation, mutation and evolution of living normal and abnormal organisms. After this general approach, let us explain what the histological technician should know and what he should be aware of.

Just take only the problem of fixation, not to speak of staining. Fixation is nothing but a part of our goal to obtain a picture of the structure of the cell, the structure of the living cell, but we kill the cell by fixation to obtain a picture of the living cell. We are doing this in spite of our knowledge that it is a *dynamic* structure of gel bodies and colloidal suspension of particles which are extremely sensitive towards changes of their surroundings. No wonder that we are always doubtful as to whether we are justified to compare pictures of cellular structures obtained by fixation, staining, etc., with living structures. Though these doubts are appropriate, they should not lead to unlimited skepticism. We may almost reach our goal if we use as many methods as possible to accomplish or better to create as many pictures and impressions of structural elements as possible. In other words, we have to use direct as well as indirect methods to achieve our purpose.

The direct method is the examination of living or surviving cells, indispensible today; only in doing this we may supplement our impressions obtained from microscopical fixed and electron microscopical studies. Single cells, blood elements, cells obtained from tissue cultures, are already thoroughly examined in animals. Human normal and pathological material is still rather neglected.

Centrifugation and application of high pressure are the two physiological methods which do not damage the living cell too much and even so the damage is reversible.

1. Cells exposed to centrifugation arrange their constituents in form of layers according to their specific gravity. Such a procedure, especially in combination with the centrifuge microscope of Harvey, is of great value for histochemical experiments and for those dealing with physiology of development.
2. Cells exposed to high pressure inhibit the formation of gel bodies and suppress the contractility of the cytoplasm, opening thereby the path for studying the physiology of the

cytoplasm.

3. Supravital staining, enzyme reactions, both reversible manipulations are rather informative.
4. Darkfield and polarization microscope *(Runstroem* 1937, *J. W. Schmidt,* 1941) are indispensable in experimental cytology.
5. The study of the living cell is jeopardized by the fact that it is highly transparent to visible light. The different intensity of the transmitted light i.e. certain changes, cannot be perceived by the human eye. But light passing through different parts of the cells undergoes changes in phase, because of slight differences in the refractive index and thickness which normally are unobserved. Result: living structures show very little contrast and are therefore difficult to see under the microscope. The phase contrast microscopy *(Zernike)* tries to overcome this obstacle. The phase microscope changes the phase differences produced by the various structures into differences of amplitude, appreciable to the eye or the photographic film. Phase-microscopy is now widely used, routinely, in the study of normal and pathological cells. The experiences obtained by this method are exceedingly rich and wide. Also the action of different chemical and physical agents on the living cell can be studied with the phase microscope. Using the living structure as a normal standard it provides also a way of checking artefacts introduced by the action of different methods of fixation and staining.
6. So far we observed cells only in a form of near survival, but the so-called tissue culture *(Carrel)* guarantees observation under more favorable conditions and enables one to follow the development of cells. It is obviously beyond the limit of time allotted to me to discuss its technique, but I only want to add that not only is histochemistry closely interwoven with this method, but physical manipulations (micromanipulator) enables us to operate on these cell cultures (microsurgery).

Finally, let us see whether the examination of the fixed cell (indirect method) is really such a waste of time for the technician interested in morphology. Only in the last decade cellular structures visualized by classical methods of fixation and staining became of new interest as up till then, these structures were considered nothing but uninterpretable coagulates. Now we know that certain stable gel bodies cannot be completely disfigured by fixation or staining and we know furthermore that high molecular proteins and nucleinic acids endure fixation and staining very well. This knowledge is widely utilized in histochemistry, and histological study of kidney diseases e.g. is partly based on this new field of histological technique and

histological research. The application of histochemistry to embryology, physiology, histology and pathology has unlimited potentialities; its techniques should be one of the most interesting fields for the technician.

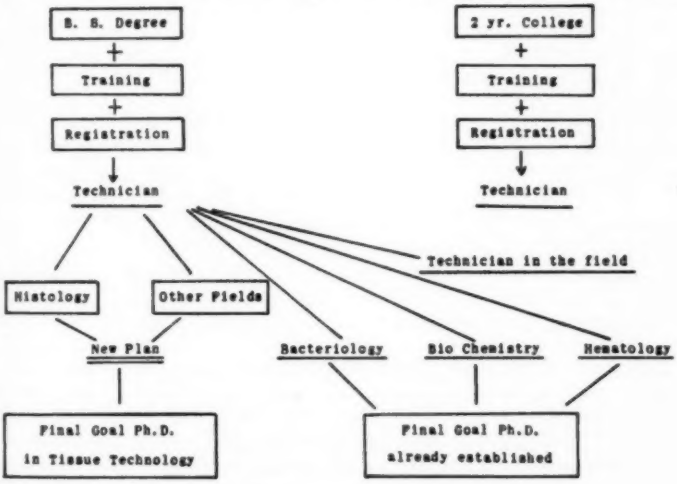
The results obtained with the electronmicroscope are extremely promising and fascinating, but the artefacts have to be recognized as such and have to be properly eliminated. The electronmicroscope gains daily in importance.

As mentioned before, the chemical modifications brought on by fixation are exaggerated. Nevertheless they take place to some extent. Fixation may produce considerable chemical modification and for certain research projects these chemical modifications have to be eliminated as far as possible. *Altmann*, 1894, conceived a method by which morphology is maintained to a large extent and by which chemical changes hardly occur. However, its practical use was only established by *Gersch* in 1932. We are referring to the method of fixation by freezing and drying. Also here I have to deny myself to convey the technique to you. Due to accomplished complete dehydration, there is no shrinkage of tissue, the fixation is almost homogenous throughout the piece, there is no extraction of soluble substances, the chemical composition is practically maintained without change and the structure in general is preserved with very few modifications produced by ice crystals. The cessation of vital phenomena is almost instantaneous and there is no time for the production of post mortem chemical alterations. This rapidity of fixation permits one to trap and preserve cells at critical moments of their function, such as the moment when kidney cells are excreting colored material or other substances. *(Gersch)*. The freezing-drying technique is an intermediary between examination of fresh and of fixed tissue and gives us the benefit of visualizing an arrested function. We are not dealing with true fixation in the strict sense, because it lacks the characteristics of complete irreversibility. Many of the cellular components are preserved in the same soluble form as in the living stage. Thus the solubility of many proteins of glycogen, salt, etc., is preserved. So, we not only see the structure, we may not only visualize arrested function, but we may also apply numerous histochemical methods. Furthermore, certain enzyme systems are also preserved, this being of great importance for histochemistry.

By now I am sure you have realized what a technologist, mainly interested in histology *should* know about the modern trends in this field and that he has to realize that he does not have a sufficient background to cope with these latest advances. Time forbids to go into other related fields of tissue

technology like screening of cytological smears and cancer diagnosis, tissue culture, experimental tumor research, etc. By now you will also have realized why, at the begining of our discussion, I mentioned histological technique to be a step child in medical technology. As practiced in our laboratory, people interested in bacteriology or biochemistry may go on and may become masters and Ph.D.'s in their fields. What is the outlook for a tissue technician, if he or she wants to attain a postgraduate degree? To my knowledge, it is not too good at the present time. But, I should like to submit to you a plan to improve the situation, provided proper integration and proper cooperation are granted and assured by a coexisting university and medical school.

The following tabulations shall convey to you our ideas on the matter. In the first table, you see on the left side the potential activities of a technologist who enters a training school after having obtained a bachelor degree in science. On the right side we took care of those who still are accepted in training schools with only two years of college. Both groups may attain the degree of a registered medical technologist after they have passed their examination. They are both now technologists in the field, as I will call it, and may be compared to the practitioner in medicine who goes into general practice after a year of internship. Those, however, who have a bachelor's degree, and only those, may climb the ladder if they should become interested in certain fields of technology, like bacteriology, biochemistry



and hematology. Taking evening classes, taking courses during summer vacation, taking leave of absence, they may obtain a master's degree or even a Ph.D., a career already well established. On the left side you see the title histology and other fields; and it is this particular phase of education that I am interested in and where I would like to make a few suggestions.

Assuming a tissue technician wants to obtain a master's degree or Ph.D. in tissue technique (I am sure we may find a better title) they would have to go through a lot of theoretical and practical courses before they could even consider devoting themselves to the chosen field. As illustrated by our second table, they should take courses in mathematics and statistics in order to be able to help in mass experiments, counting, etc.

New Plan

Theoretical and Practical courses required in order to obtain M.S. & Ph.D. in Tissue Technology.

1. Mathematics and Statistics
2. Physics
   - Nuclear — Electron microscopy
   - Optical — Phase microscopy
3. Chemistry
   - Biochemistry
   - Photographic Chemistry
   - Chemistry of dyes

1. Advanced Biology
2. Advanced Zoology
3. Bacteriology
4. Embryology
5. Anatomy
6. Physiology
7. Histology
8. Cytology
9. Pathology
10. Tissue culture

(7–10: Histochemistry)

11. Experimental tumor research
12. Anatomy and Pathology of Laboratory animals
13. Medical Photography & Illustration

Thesis

Potential special Board Examinations in two or more fields.

The Ph.D. in Tissue Technology can never assume the responsibility or obligation of a Pathologist M. D. who is always in charge of the entire laboratory. There should be a close scientific cooperation in research.

Only advanced courses in mathematics and physics (nuclear as well as optical) will enable them to work with the electron microscope or with the phase microscope; extensive studies in chemistry (biochemistry, photographic chemistry, chemistry of dyes) will provide the background for histochemistry, cytochemistry, medical photography, etc. Courses in advanced biology, zoology, bacteriology, survey lectures on embryology, anatomy, physiology, pathology, practical courses in cytology and screening of cytological smears, in tissue culture, practical studies in tumor transplantation, the study of the normal and abnormal behavior of laboratory animals should be required. Obviously only a few fields can be chosen to obtain a master's or Ph.D. degree, e.g. histology, cytology, tissue culture and histochemistry could be combined very well. That other combinations are possible is evident. Like in other fields, the candidate should write a thesis, should then get his degree, but in analogy to registration examination for general technologists on the one hand and to special boards for doctors on the other, a special board examination in one or two fields for tissue technology should be considered.

Like in other fields of medical technology, where masters and Ph.D.'s supervise the activities in their respective departments, the master or Ph.D. in tissue technology can never assume the responsibility or obligations of a pathologist M.D. who is always in charge of the entire laboratory, but cooperation in running the laboratory and mutual assistance on an equal basis in research and scientific investigation cannot be close enough.

You will admit that an institution like the University of Miami where all the departments are very competent to handle such courses, (even an electron microscope is there) could be a pioneer in this new field of medical technology. My close affiliation with this institution encourages me to submit these plans to the authorities and I hope that they will meet with proper consideration.

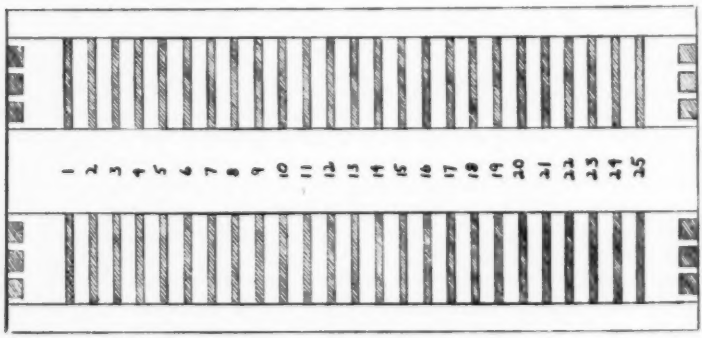
In his book on Pathogenetic Medicine and Surgery, Cancer, Correlative Medicine, etc., the French pathologist, *Michel Mosinger*, advocates the following attitude towards modern medicine: The time of synthesis has arrived where biology and medicine are comprehended with the help of other sciences, like physics, nucleophysics and chemistry. This leads to a new encyclopedic science which tries to search for the problems of life and of men with clearness and with a goal to eliminate Carrel's "Un-known." Although the author illustrates this synthesis with numerous examples like that where each administration of hormones induces changed chemical reactions and each

nervous disturbance leads to an endocrinal reaction, in my opinion the "Un-known" will still remain for a long time to come. But it is with the help of all these sciences that we may shorten it, even for an infinitesimal period.

FROM OUR READERS

By ALTHEA BARLOW, M.T. (A.S.C.P.), *Mercy Hospital Laboratory, Baltimore, Md.*

For the benefit of labs now using the micro-hematocrit, here is a neat and safe tray for the purpose of lining up the capillary tubes for easy transportation to the centrifuge: Take an ordinary wooden slide box, (25 slide capacity), and knock the ends off with a hammer. Then carefully separate the grooved sides from the bottom. A knife does this nicely. Glue the grooved sides face up onto the bottom, leaving about ½ inch between, so that the grooves will be aligned with each other and with the correct number printed on the bottom of the slide box. The capillary tubes can then be lined up according to number. Since most labs collect tubes in duplicate, it should be known that the grooves are deep enough to hold two tubes. To remove the tubes, simply grasp the ends between thumb and forefinger. This same tray is frequently used for drying differential smears.



DEMONSTRATION OF ANTI-KELL BY ROUTINE BLOOD BANK PROCEDURES

By EDITH L. BOSSOM, A.B., M.T. (A.S.C.P.)
University of Kansas Medical Center, Kansas City, Kansas

I. Brief Review of the K-k Blood Group System

Coombs, Mourant and Race[1] described the first sample of anti-Kell antibody in 1946 in the blood of a woman who had given birth to an infant suffering with hemolytic disease of the newborn. The child's cells gave a positive direct Coombs test which could not be explained on the basis of Rh incompatibility. No naturally-occurring Kell antibodies have been observed but numerous immune examples have been recognized in the sera of patients sensitized through blood transfusion or pregnancy.

The possibility that Kell is part of the Rh system has been investigated[2] for two reasons. First, the clinical effects of immunization are very similar and second, antibodies produced by both antigens are usually of the incomplete type. Results of family studies[3] and distribution in the general population reveal that there is no antigenic relationship. Kell is inherited independently of Rh, ABO and the other blood groups.

The presence of the Kell antigen in the red cell is determined by the presence of the gene K on the chromosome. K has an allelomorph which has been recognized[4] and named k. The k factor has the extremely high incidence of 99.8%. Nevertheless, a few examples of anti-k[4, 5, 6] have been found in the sera of homozygous KK persons sensitized through pregnancy or transfusion. No blood has been reported which fails to react with either anti-K or anti-k.[7] Thus, an individual may be homozygous Kell positive (KK), heterozygous Kell positive (Kk) or Kell negative (kk). Kell positive persons (KK and Kk) make up approximately 10% of the population. A comparison of the incidence of Kell and Rh D (10% and 85% respectively) indicates why more Rh antibodies are found, even though Kell is probably as strong an antigen as Rh D.[2]

II. Hemolytic Disease Due to Anti-Kell

Kell antibodies, like Rh and Hr antibodies, coat the cells of an infant suffering from hemolytic disease of the newborn. The direct Coombs test will be positive. It is advantageous to identify the antibody involved in order to choose compatible blood for exchange transfusion, i.e., donor blood lacking the antigen which has sensitized the mother. Usually a panel of bloods whose full blood groups are known* is helpful in the identification of Kell antibodies. In the following case the direct Coombs test in addition to ABO, Rh and Kell typings of mother, father and infant were sufficient to establish a laboratory diagnosis of hemolytic disease due to the Kell antigen.

CASE NO. I

The blood of a newborn infant gave a weakly positive direct Coombs test. The pediatrician requested that the laboratory repeat the test because both parents had been typed previously as Rh positive. Four different commercial anti-human globulin sera were employed in the repeated Coombs; all tests were positive. Inquiry revealed that this was the third pregnancy. The first child was living and well; the second pregnancy had terminated in a hydrops fetalis. Blood specimens from mother, father and older child were sent to the laboratory for study. ABO, Rh and Hr typings were done first since these blood groups are more commonly implicated in hemolytic disease. The results (see below) of this preliminary testing eliminated the probability of ABO or Rh involvement. Kell typings were then performed.

Mrs. A.....group A, Rh + (DCe/DCe), K neg.
Mr. A.....group A, Rh + (DCe/DCe), K +
Dia. (5 yr.) .....group A, Rh + (DCe/DCe), K +
Den. (infant) .....group A, Rh + (DCe/DCe), K +

Some difficulty was encountered in performing a Kell typing on the baby's blood. Anti-Kell typing serum contains antibodies which coat Kell positive cells, resulting in a positive indirect Coombs test. The infant's cells were already coated with antibody from the maternal circulation. However, the Kell typing produced very strong agglutination while the direct Coombs, as mentioned above, was only weakly positive. It was therefore assumed that the infant could be correctly classified as Kell positive. A unit of fresh group A, Rh positive, Kell negative blood was crossmatched for the baby but transfusion was not found necessary.

Mr. A's cells were readily coated by the antibodies present in both his wife's and infant's sera, as demonstrated by the indirect Coombs procedure, and his cells were conveniently used in the titration of Mrs. A's serum. Serial double dilutions of the unknown serum were made in saline and Mr. A's Kell positive saline suspended cells were added to each tube. Following a two hour incubation in a 37°C. water bath, a Coombs test was carried out on every tube of the titration. A titer of 1:8 was obtained by this method. A specimen of Mrs. A's blood was later sent to a laboratory equipped for more thorough investigation, where it was determined that anti-Kell was the only antibody involved.

III. Indirect Coombs Incompatibility Due to Anti-Kell

The safe transfusion of patients sensitized to Kell or one of the other "new" antigens is becoming a more frequent blood bank problem. The greater use of whole blood in recent years is creating innumerable opportunities for immunization. Crossmatching

* Kell positive cells and Kell typing serum are available commercially.

techniques in which donor cells are trypsinated or suspended in saline, serum or albumin cannot be depended upon to disclose the presence of Kell, Duffy or Kidd antibodies in the patient's serum. These antibodies are consistently demonstrated only by the indirect Coombs procedure. It is therefore advisable to perform the indirect Coombs crossmatch whenever a previously transfused patient requires blood. Ideally this crossmatch is a routine procedure for every patient since complete transfusion and pregnancy histories are not always available. The following case illustrates how a probable hemolytic transfusion reaction was avoided by the indirect Coombs compatibility.

CASE NO. 2

L.B., a 50 year old woman, was admitted for major surgery. She had no children but had received transfusions during a previous surgery. Routine blood typing was carried out and crossmatches set up with three units of group A, Rh positive blood. Saline crossmatches performed at room temperature were compatible. Albumin crossmatches incubated at 37°C. were also compatible. The indirect Coombs tests revealed strong agglutination of donor cells in two of the three units. On the basis of the crossmatching results Rh and Hr antibodies were not thought to be involved because these antibodies will react in an albumin medium. The proportion of incompatible donors suggested a Duffy antibody but the patient typed Duffy positive and could not therefore be immunized to this antigen. More extensive typing of the patient's and donors' bloods indicated Kell sensitization.

Patient L.B. group A, Rh + (DCe/dce), S +, Fy^a +, K neg.
Incomp. Donor 1.....group A, Rh +, K +
Incomp. Donor 2.....group A, Rh +, K +
Comp. Donor.....group A, Rh +, K neg.

The presence of Kell antibodies was confirmed by a panel of known cells. An indirect Coombs titer of the patient's serum gave a 1:32 reading. This particular example of anti-Kell did not react either in a serum crossmatch as described by Grove-Rasmussen[8] or in a saline medium incubated at 37°C.[9] The indirect Coombs crossmatches were set up with equal parts of patient's serum and donor's saline suspended cells, incubated at 37°C. for 15 minutes[10] and washed three times with tubes full of fresh saline. The tests were then completed according to the directions of the manufacturer of the Coombs reagent.

Summary

The Kell antigen is of clinical importance because it may cause both hemolytic disease and hemolytic transfusion reactions. The

increasing number of Kell sensitizations being reported indicates that anti-Kell is no longer one of the rarer antibodies. Through the routine use of the direct and indirect Coombs tests the pediatrician may be aided in an earlier diagnosis of hemolytic disease of the newborn and severe transfusion reactions may be avoided.

REFERENCES

1. Coombs, R.R.A., Mourant, A.E., and Race, R.R.: In-vivo isosensitization of red cells in babies with haemolytic disease. Lancet, **1:** 264-266, 1946.
2. Race, R.R., and Sanger, R.: Blood Groups in Man. C. C. Thomas, Publisher, Springfield, Ill., 1950.
3. Shapiro, M.: Observations on the Kell-Cellano (K-k) blood group system. S. Afr. Med. J., **26:** 951-954, 1952.
4. Levine, P., Backer, A.M., Wigod, M., and Ponder, R.: A new human hereditary blood property (Cellano) present in 99.8% of all bloods. Science, **109:** 464-466, 1949.
5. Levine, P., Kuhmichel, A.B., and Wigod, M.: A second example of anti-Cellano (anti-k). Blood, **7:** 251-254, 1952.
6. Crawford, H.: A third example of the blood group antibody anti-k. J. Clin. Path., **6;** 52-53, 1953.
7. Levine, P., Wigod, M., Backer, A.M., and Ponder, R.: The Kell-Cellano (K-k) genetic system of human blood factors. Blood, **4:** 869-872, 1949.
8. Grove-Rasmussen, M., Dreisler, N., and Shaw, R.S.: A serologic study of 8 samples of anti-Kell serum. Am. J. Clin. Path., **24:** 1211-1219, 1954.
9. Dunsford, I.: A saline agglutinating Kell antibody. Nature, **163:** 962, 1949.
10. Haber, J.M.: Indirect Coombs compatibility. Am. J. Med. Tech., **20:** 156-159, 1954.

THE ROLE OF A REGISTERED MEDICAL TECHNOLOGIST IN A PHYSICIAN'S OFFICE*

By MATTIE SUE DETRO, M.T. (ASCP)

Due to the rapid growth of medicine, the discovery of the antibiotics, the use of blood and its products, and new and more radical procedures of surgery, the medical technologist has progressed from a very humble beginning to a permanent and lasting place in the field of medicine. These new approaches in therapy have brought with them the demand for broader methods of diagnosis based on a greater variety of laboratory tests for their administration and control. In the past, the physician was expected to perform all the necessary work; however, since the rapid growth of medical training required more specialization, the Registry was organized in 1928 by the American Society of Clinical Pathologists. Thus the Registry of Medical Technologists came into being and the American Society of Medical Technologists was founded. As a result of these movements, professional schools were organized to train technologists to perform these complicated and time-consuming procedures. These steps, in many cases, solved the technical problem for the hospital, but left the private physician to care for the necessary laboratory tests within his own practice. The goal of all medicine today is better care for the patient and the availability of a technologist for laboratory procedures in the office is a step in that direction. A blood count or urine examination completed while the patient is in the office can mean the early beginning of necessary and sometimes lifesaving treatment; in contrast to delayed studies, delayed reports and unfortunately, delayed therapy.

By including a registered technologist in his office personnel, the physician has discovered that accurate tests can be performed rapidly, thus aiding his diagnostic and therapeutic accuracy. It is often of prime importance for the physician to have laboratory results available immediately before prescribing certain medications and to be able to follow the action of these drugs during the course of administration.

The technologist will find the greatest volume and variety in the office laboratory of an internist or a general practitioner, although there is a place and a need for her in the office of any practicing physician. She is qualified by virtue of her training not only to perform the necessary laboratory tests, but is also a valuable assistant to the physician.

Many tests, such as the basal metabolic rate, are especially well suited to the office practice as many patients prefer to avoid hospitals. As hospital atmosphere often instills apprehension, causing emotional instability, the patient is far from being in a basal condition. If, however, the patient is to come only a short

* Read before ASMT, June 1955, New Orleans, Louisiana.

distance from his home to a familiar place, he is often in a more receptive mood and hence in many instances a better and more accurate test is obtained. The electrocardiograph is even better suited to the office. Many cardiac patients are unable to leave their homes for this test and yet its performance is vital for their correct treatment. Few hospitals have a service which provides for conducting this test in the home, but for the physician with a technologist and a machine it is a simple matter. Many patients have a surprising reaction when a strange person attaches a machine to them in such a manner that it appears as though they are going to be electrocuted. The personal relationship between the patient, physician and technologist is an added factor toward obtaining a good tracing as less alarm is present in the cardiac patient. These are just two examples of simple tests which save both the patient and the physician valuable time in diagnosis and therapy and are performed routinely in the office with a minimum amount of equipment.

Naturally, there are many tests such as bacteriological cultures and complicated time-consuming chemical analyses which, because of equipment, complexity, or infrequent demand, are not adaptable to the small office laboratory. These can be performed more easily and with greater accuracy in a hospital or private laboratory. The purpose of the average physician's office laboratory is to serve the physician and the patient with prompt, accessible and accurate tests which are of a limited scope and in no way replaces the facilities of the modern hospital laboratory or efficient private laboratory.

The office technologist is much more economical in the use of such equipment as film, gauze, slides and solutions as extravagance and waste are much more obvious in a small laboratory than in the larger hospital or clinic laboratories. The office technologist should be able to keep her equipment in correct operating order and to make repairs of a minor nature. Such operations as changing film and fuses in the electrocardiogram or cleaning and adjusting the basal metabolism machine are simple every day procedures which save time and prevent breakdown at the time these instruments are most needed. The technologist must be able to improvise, substitute and adapt herself to any difficulty to produce accurate tests without violating her accuracy or technique. In many cases, she must obtain not only specimens for tests to be performed in the office; but must also collect samples to be transported to the hospital laboratory. This is another convenient service for the patient which may prevent an unnecessary hospitalization and increased financial expense.

The office technologist has an opportunity to learn an aspect of medicine which is unknown to her hospital sister. This is the opportunity to become better acquainted with diagnosis and

medication. To the hospital technologist each patient becomes familiar by virtue of some particular condition, operation, specimen or unusual illness. In the office, the technologist has the opportunity to know each patient as an individual and to become interested in each of them personally as well as with their laboratory status. It is advantageous, also, to be able to observe the patient from therapy to the result of the tests in correlation with the diagnosis and therapy administered. In many instances, the advice of the technologist is sought concerning the most adaptable test to establish an early diagnosis. Often many latent talents are awakened in the technologist when it becomes necessary to assist in other routine duties in a physician's office; for example, a knowledge of typing and bookkeeping make her an even more valuable asset to her employer.

The registered technologist always has the opportunity to publicize her profession and awaken in the public the desire to expect her specialized training, just as the public now expects registered nurses or physicians from qualified professional schools. It is, therefore, to the advantage of the technologist to always wear her Registry Patch or Pin and display her certificate of registration in the laboratory. It is often possible for the technologist to interest young patients in her profession and to recommend outstanding schools of medical technology. It is unique, but true, that more private physicians and clinics require registered technologists than do hospitals.

The office technologist must conduct herself in such a manner that both the patient and the physician will have confidence in her work. It is upon the integrity of the technologist that the welfare of the patient and the success of the diagnosis and therapy of the physician depend. A well equipped and modern laboratory has no importance without a technologist of outstanding integrity. For example, if only a blood count and urine are ordered and the urine is abnormally dark the technologist should report this to the doctor, even doing additional tests such as blood or urine bile studies. Foremost—the office technologist must think. She is not an automaton, but must and does assume an intimate part in the diagnosis and therapy of her patients. She must be aggressive and ever alert as the welfare of the patient depends on the personal standards of the technologist. The physician is dependent upon thorough reports; therefore, when there is any uncertainty as to the accuracy of a report such doubt should be expressed to the doctor. An inaccuracy, whether due to carelessness, inaccurate instruments, or even accidental causes, can lead to unnecessary morbidity, hospitalization or death; therefore, the moral integrity of the technologist is vitally important.

In addition to the moral obligation to herself, the medical

technologist has a legal obligation to her employer to do nothing which might cause injury to an innocent third person. It can be seen, then, that a legal as well as a moral obligation are essential requirements in medical technology.

The office technologist can often aid the physician by recording a part of the patient's history. As the patient often talks more freely to the technologist, the history is frequently more revealing. It is considerably more difficult to be a good office technologist than to be associated with a large laboratory in a nominal department. Although a technologist must always possess humility and modesty in her relations with the patient and physician, she must also possess a great amount of confidence as the results of all laboratory tests are her sole responsibility. There are no routine anonymous tests as each patient has personally placed his confidence and trust in the technologist.

The office technologist should not, however, have full responsibility for the diagnosis but should always have the opportunity of consultation with the physician and pathologist. It is no disgrace to admit that a blood differential is hard to interpret or that a urine sediment is unusual. No one is infallible, hence it is to the benefit of the technologist, the doctor and the patient to seek consultation when there is any reason for doubt. As any properly organized laboratory will have free exchange of information, the technologist should never hesitate to take advantage of this service. The private office laboratory is not in competition with the larger laboratories, but is providing service to the doctor and his patients with limitations. Thus the unusual test that is not often performed and the more difficult procedures should be referred to a larger laboratory.

As the technologist sometimes serves as the office nurse and as she wears a white uniform with a badge, the patients may consider her an authority on all aspects of medicine. Occasionally, the technologist is required to check the medication prescribed by the physician, therefore caution must be exerted as one misunderstood word can destroy the confidence of a patient in his treatment. The technologist must realize that the patient has the same human frailties as she and that there are times when an attitude of personal interest is more important than the result of a blood count or blood chemistry.

There are many advantages in working in an office laboratory. The absence of night calls and the shorter hours of work are among the most obvious and enticing. With the proper amount of equipment approximately ninety percent of the necessary tests can be performed in the office laboratory. Any room accesible to the waiting room and to the physician's office, equipped with running water and gas, is suitable to become the laboratory, and can be as large or as small as space, money and necessity permit.

The office laboratory may often seem very humble when compared to hospital laboratories equipped with the latest and most modern equipment and facilities.

There are, of course, disadvantages in working in a private office. The variety of tests are limited in number and there is little opportunity for advancement in either position or salary. In the office, a technologist sometimes longs for professional associates and the mutual exchange of information and advice. This may be prevented by maintaining an up-to-date library and through frequent consultations with the physician, technologist, and pathologist in the hospital. Ultimately, it is found that many of the techniques common to the hospital laboratory are forgotten, but by remaining conversant with the current literature and attending technical society meetings, the office technologist can remain abreast with the hospital worker.

It would seem unnecessary to mention that the most vital piece of equipment for any office laboratory is a good microscope which has high, low and oil objectives. It is necessary to use calibrated pipettes and glassware of the proper type and size for a successful test to be performed. A centrifuge of sufficient capacity and capable of high speed is an essential item. Such equipment as mechanical pipette shakers, washers, and counters are extremely useful and time saving, but are not absolutely essential. The provision of fresh solutions and fresh stains is equally important. Unless an analytical balance and storage space for numerous chemicals are available, it is far simpler to purchase prepared solutions and stains from a reputable pharmaceutical firm.

Due to the rapid growth of this new field of medicine, there is a great demand for properly trained medical technologists. There are approximately 20,000 qualified technologists registered by the American Society of Clinical Pathologists and the aim is to have 45,000 certified technologists by 1960. To reach this goal there must be a more concentrated recruiting program as well as an increase in qualified training facilities. Not only is the registered technologist needed in the hospital, but as long as medicine continues to grow and more clinical investigation becomes necessary, there will be a demand in the physician's office far greater than the approved professional schools can supply at the present rate.

It must always be remembered that medicine remains an art and regardless of how scientific it may become, the charlatans and quacks will persist and multiply until the scientist, the technologist and the physician unite under one goal; to make the human being—our patient—feel better. As an office technologist, I feel that I am closer to this goal than ever before.

AN INTRODUCTION TO THE "THROMBOPLASTIN GENERATION TEST"*

By DORIS M. DEDE, A.B., M.T. (ASCP)*

* Chief Technologist, Drs. Mills, Patterson & Leonard Laboratory, Tampa, Florida

The Thromboplastin Generation Test was described by Biggs & Douglas in the British Journal of Clinical Pathology in February, 1953. The test is of great value in bleeding cases of an obscure nature since it not only is the most sensitive test to measure a defect in Stage I of the coagulation mechanism, but it will also show which factor in Stage I is deficient. (Fig. 1).

Fig. I **Clotting Scheme**

Platelets

Plasma ↓

Stage I AHG, PTC, PTA {Platelet, Thromboplastic, Factor} + Convertin + Ca^{++} → Plasma Thromboplastin

Stage II Prothrombin + Accelerin + Convertin + Ca^{++} + Plasma Thrombo Plastin → Thrombin

Stage III Fibrinogen + Thrombin → Fibrin

The Thromboplastin Generation Test will detect (1) deficiencies of the plasma factors, AHG (Anti-hemophilic Globulin), PTC (Plasma Thromboplastic Component), and PTA (Plasma Thromboplastin Antecedent); (2) quantitative platelet deficiency (thrombocytopenia) and qualitative platelet deficiency (thromboasthenia); (3) convertin deficiency; or (4) the presence of a circulating anticoagulant of the anti-thromboplastin variety. In these conditions there will be either a delay, a decrease or an absence of plasma thromboplastin formation.

Physiological coagulation is dependent upon the formation of a powerful thromboplastin as outlined in Stage I of the clotting mechanism. This sensitive test, which measures specifically plasma thromboplastin concentration, will show deficiencies of any of the factors involved in this equation, except calcium, which is rarely, if ever, low enough in life to cause a delay in plasma thromboplastin formation.

In this test, plasma thromboplastin is generated in a test tube (which I will refer to hereafter as the TG tube). At one minute intervals, from one to six minutes, a small portion of the mixture is removed from the TG tube and is added together with calcium chloride to a tube of normal control platelet-poor plasma substrate (indicator system) and the clotting time of the substrate is accurately timed with a stop watch. This substrate contains all the factors needed to complete Stage II except plasma thromboplastin (which is being added from the TG tube) and calcium.

* Read before ASMT, June 1955, New Orleans, Louisiana.

Once thrombin is formed, Stage III is quickly completed. Since the TG tube contains none or only a minimal amount of prothrombin, the plasma thromboplastin generated in the TG tube remains as such and it is the active agent transferred to the tube of normal control substrate together with $CaCl_2$ to complete Stage II and Stage III. The test is run in the 37 degree water bath and the whole procedure is first carried out using all constituents of a normal control. (Fig. II).

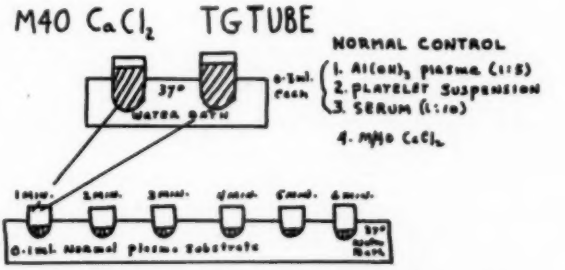
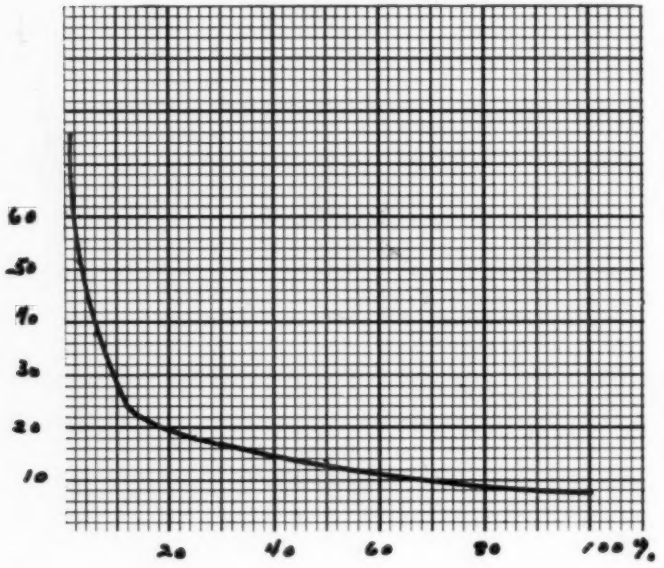


Fig. II

The mixture in the TG tube at first consists of the following: (1) normal control plasma which has been treated with aluminum hydroxide (hereafter called alumina plasma) which supplies AHG and PTA; (2) normal control platelet suspension which furnishes the platelet thromboplastic factor; (3) normal control serum which supplies PTC, PTA, and Convertin; and (4) calcium chloride. A stop watch is started the instant the calcium chloride is added to the TG tube and at one minute intervals, (for six minutes) 0.1 ml of the mixture is removed from the TG tube and is simultaneously added with 0.1 ml of calcium chloride to 0.1 ml of normal plasma substrate. The clotting time of the substrate is accurately measured by a stop watch. The plasma thromboplastin generated (using the constituents of a normal control) is sufficient after 4 to 6 minutes incubation to clot the substrate in 10 seconds. A substrate clotting time of 10 seconds or less is considered as 100% thromboplastin generation. Dilu-

tions of this 100% thromboplastin are made and 0.1 ml of each is added with 0.1 ml of calcium chloride as above, to normal plasma substrate, and the clotting time is noted. From these figures a dilution curve is plotted. (Fig. III).

THROMBOPLASTIN DILUTION CURVE



% Thromboplastin

The test is performed by substituting in a TG tube (one constituent at a time) either the patient's alumina plasma for the control alumina plasma, or the patient's serum for the control serum, or when indicated, the patient's platelet suspension for the normal platelet suspension. The thromboplastin generated by each mixture is determined by means of the indicator system (normal substrate) described above. For example, if the patient's serum is used in the TG tube and at the end of six minutes incubation clotting of the substrate did not occur for 38 seconds, we can state from the dilution curve that approximately 7% plasma thromboplastin was generated.

The same substrate is used throughout and never more than one component is substituted at a time. In other words, in the TG tube, two of the components from the normal control are always used and one from the patient. For example, if one suspects an AHG deficiency, one substitutes first the patient's alumina plasma in the TG tube in place of normal alumina plasma and if the patient is a true hemophilic, the plasma thromboplastin is formed slowly and in minimal amounts in the TG tube so that even at the end of 6 minutes incubation, not enough plasma thromboplastin has been formed to clot the substrate in twenty to forty seconds or longer. However, if the hemophilic's serum or platelet suspension is substituted in the TG tube, then the clotting of the substrate will occur in normal time (10 seconds or less). This proves the patient's deficiency is in his plasma. (Fig. IV).

Normal Alumina Plasma Contains: AHG and PTA
Normal Serum Contains: PTC, PTA, and Convertin
DECREASED THROMBOPLASTIN GENERATION CAUSED BY:

Components of patient's blood	Factor	Disease
(1) alumina plasma only	AHG Deficiency	Classic Hemophilia
(2) serum only	PTC Deficiency	Christmas Disease
(3) alumina plasma and serum	(a) PTA Deficiency	Rosenthal's Disease
	(b) Presence of a circulating anticoagulant*	
(4) platelet suspension	(a) Normal or increased. Thromboasthenia number of platelets	
	(b) Decreased number of platelets	Thrombocytopenia

If Christmas disease is present, then substituting only the patient's serum for the control serum in the TG tube would bring about a decrease and a delay in plasma thromboplastin formation. If decreased plasma thromboplastin generation occurs with both the individual substitution of the patient's alumina plasma (for the control plasma) and in another TG tube individual substitution of the patient's serum (for the control serum) then PTA deficiency or a circulating anticoagulant of the antithromboplastin variety is present. If the substitution of the patient's platelet suspension causes a decrease in plasma thromboplastin generation, then a platelet deficiency (qualitative or quantitative) is present. A platelet count or platelet estimation from a

* Presence detected by checking the clotting time of a mixture of the patient's blood and normal blood.

well made smear will distinguish between these two types of platelet deficiencies. A Thromboplastin Generation Test is seldom necessary in the diagnosis of thrombocytopenia, but it is of inestimable value in thromboasthenia.

We have had gratifying results with this test in differentiating between classic hemophilia and those with a hemophilic-like disease—Christmas Disease (PTC deficiency) and Rosenthal's Disease (PTA deficiency). The severity of the deficiency can also be assayed by the per cent of thromboplastin generated. From the standpoint of treatment and prognosis, it is essential to differentiate these hemophilic-like diseases from true AHG deficiency.

Recently we had two unexplained bleeding cases referred for complete hemorrhagic studies. Both patients had laboratory tests performed elsewhere and had had multiple transfusions and both were still bleeding when we first saw them. When we studied these patients, both of them had normal bleeding and clotting times, but the first patient had impaired prothrombin consumption which indicated a defect in Stage I (Fig. 1). The Thromboplastin Generation Test showed the defect to be in his platelet factor, for when his platelet suspension was used in the TG tube, the substrate at the end of six minutes incubation took 48 seconds to clot.* This indicated that approximately 4% of the normal plasma thromboplastin was generated. Since the platelet count was normal in this individual, we were dealing with a case in which the platelet were more resistant than normal platelets so that they did not break down readily to release the platelet thromboplastic factor. A mixture of half of his platelet suspension and half normal platelet suspension completely corrected the defect. The recommended treatment for patients with platelet dysfunction is fresh whole blood via plastic bag. (This is considered equally as effective as concentrated platelet transfusion and it is much easier to obtain from the average blood bank). Fresh whole blood administered in this manner corrected his defect sufficiently so that the bleeding stopped. This patient at this time is clinically fully recovered and his Thromboplastin Generation Test shows that now his platelet suspension generates approximately 65% plasma thromboplastin.

Our other recent unexplained bleeding patient had a normal prothrombin consumption test but the more sensitive Thromboplastin Generation Test demonstrated his defect to be in his serum, for when his serum was used in the TG tube, there was both a delay and a decreased amount of plasma thromboplastin formed. He generated approximately 7% plasma thromboplastin at the end of 6

* Drs. Mario Stefanni of Boston and Dr. J. N. Patterson of Tampa are preparing a paper for publication on this patient and a similar case.

minutes incubation when his serum was substituted in the TG tube for the normal control serum. A mixture of two-thirds his serum and one-third normal serum in the TG tube yielded 100% thromboplastin generation. This patient also had a slightly elevated prothrombin time (defect in Stage II). (Fig. I.) As a result of this work we believe this patient has PTC deficiency (Christmas Disease). There may also be a mild convertin deficiency present and this would explain the slight prolongation of the prothrombin time. Unfortunately this patient had required multiple transfusions before we studied him, so we cannot say categorically that he had no other defect in the clotting mechanism but we can state definitely from the Thromboplastin Generation Test, that the patient does have a deficiency in his serum. Aged plasma or aged serum were recommended for this patient and after 5 days the bleeding stopped. Whole blood may be used but it would require approximately twice the amount to correct the defect. Fresh whole blood would be unnecessary and should be reserved for patients with hemophilia, thromboasthenia, or thrombocytopenia.

Since the specific treatment of these patients with various hemorrhagic manifestations depends solely upon the proper diagnosis, one can readily see why such a test as the Thromboplastin Generation Test plays such an important role in the armamentarium for the bleeding patient.

THE THROMBOPLASTIN GENERATION TEST

I. Obtaining the Specimens

A. From a normal individual, using a 30 ml siliconed syringe and arquad-treated needle #19 or 20, withdraw 28 ml of blood and distribute as follows:

1. Add 10 ml of blood to each of two siliconed thick-walled graduated centrifuge tubes, each of which contains 1.0 ml of 3.8% sodium citrate. Mix.
2. Into a test tube containing 0.5 ml of 3.8% sodium citrate, add 5 ml of blood. Mix. Centrifuge for 5 minutes at 2000 RPM. Remove the supernatant and label "normal control plasma." Refrigerate.
3. Into a tube containing 3 glass beads, add 3 ml of blood. Stopper tube and invert repeatedly until clotting occurs. (This process utilizes AHG, etc. and encourages the conversion of prothrombin to thrombin during coagulation.) When coagulation is complete, the blood is allowed to stand for 2 hours or more in a 37 degree water bath for the complete neutralization of thrombin, maximum utilization of prothrombin, and disappearance of active thromboplastin. Centrifuge. Label "normal serum." Refrigerate.

B. From the patient—if the defect is suspected to be in the

plasma or serum (AHG, PTC, PTA deficiencies, and not in the platelets), then using a 10 ml syringe, withdraw aproximately 8 ml of blood and distribute as follows:

1. 5 ml is added to a tube which contains 0.5 ml of 3.8% sodium citrate. Mix. Centrifuge at 2000 RPM for 5 minutes. Remove the supernatant and label "patient's plasma."
2. Into a tube with 3 glass beads, add 3 ml of blood. Stopper and invert tube until clotting occurs. Allow it to stand for 2 hours or more in a 37 degree water bath. Separate the serum after centrifugation and label "patient's serum." Refrigerate.
3. If a platelet deficiency, especially qualitative, is suspected, then an additional 10 ml of blood must be obtained from the patient. This blood is added to a siliconed thick-walled centrifuge tube containing 1.0 ml of 3.8% sodium citrate. The patient's platelet suspension is prepared in the same manner as the control platelet suspension. (Use a siliconed syringe).

II. Preparation of Platelet Suspension, Substrate, Alumina Plasma and serum

A. Preparation of platelet suspension and substrate from tubes IA. Centrifuge both siliconed tubes at 1500 RPM for 10 minutes and the plasma containing platelets from each is transferred into a thick-walled graduated siliconed-treated centrifuge tube. Make a note of the total number of ml of plasma. Centrifuge this tube at 3000 RPM for 15 minutes. The platelets are deposited in the tip of the tube and the clear supernatant plasma is removed and is labeled "normal control substrate." Refrigerate this tube. The platelets are washed twice with normal saline, the platelet mass being fragmented by a wooden applicator stick and redeposited on each occasion by centrifuging. After the second washing, the platelets are re-suspended in a volume of 0.85% saline equal to one-third (⅓) of the original volume of plasma from which they were derived. The suspension is used undiluted for the test and may be used that day and on the day after preparation. Refrigerate.

B. Preparation of alumina plasma—From both the normal control and from the patient, place 2 ml of plasma from each into separate test tubes. To each add 0.2 ml of alumina hydroxide suspension. Mix. Incubate the tubes in a 37 degree water bath for 3 minutes. Centrifuge for 15 minutes at 3000 RPM. Remove the supernatant plasmas and label "normal alumina plasma" and "patient alumina plasma." Refrigerate. The patient's and the normal alu-

mina plasma are each tested by the one stage prothrombin test and the result should be between 1 and 4 minutes. (This treated plasma contains AHG and PTA but lacks PTC and convertin.) For use in the Thromboplastin Generation Test, both the patient's and the normal control alumina plasmas are diluted 1:5 with 0.85% saline. Alumina plasma must be prepared the day it is to be used and the diluted plasma should be used within 1 hour.

C. Serum from both the patient and normal control are diluted 1:10 with 0.85% saline before use. The serum factors are relatively stable on storage and may be used for some days after collection.

III. Technique of the Test

A. Immediately before starting the test, pipette 0.1 ml of normal control substrate into each of six small tubes (Kahn size). Place in the 37° water bath.

B. Into the TG tube place the following:

1. 0.3 ml of normal alumina plasma (diluted 1:5)
2. 0.3 ml of platelet suspension from the normal control
3. 0.3 ml of normal serum (diluted 1:10)

Incubate the mixture in the 37 degree water bath for 2 minutes and add:

4. 0.3 ml of calcium chloride. A stop watch is started the instant the calcium chloride is added. Mix.

C. At intervals of 1 minute up to 6 minutes, 0.1 ml of the mixture in the TG tube is withdrawn into a Pasteur pipette and using the other hand, 0.1 ml of calcium chloride is withdrawn into a second pipette (we prefer to have a second technologist add the calcium chloride). The contents of the two pipettes are simultaneously discharged into one of the tubes of substrate. A stop watch is started and the clotting time of the substrate is noted. If it does not clot in 50 seconds, then discard this tube. It is usually not necessary to continue the incubation of the TG tube for more than six minutes. The clotting time of the substrate gives a measure of thromboplastin concentration in the incubation mixture and may be expressed in terms of per cent thromboplastin generation by using a thromboplastin dilution curve.

IV. Preparation of Thromboplastin Dilution Curve

A potent preparation of plasma thromboplastin, as made in the TG tube above, will usually cause clotting of the substrate in 8 to 10 seconds. This is considered 100% thromboplastin generation. Deterioration of the thromboplastin in the TG tube can be delayed by placing it in an ice bath. This mixture (100% thromboplastin) in the TG tube may be

diluted with saline to make the following dilutions: 1:2 with NaCl = 50% concentrations, 1:4 = 25%, 1:8, 1:16, 1:32. These different dilutions of thromboplastin are also kept in melting ice and tested with normal plasma substrate as above. Each tube is warmed up for two minutes prior to determining its thromboplastin content. A curve relating clotting time and thromboplastin concentration can then be drawn. (See Fig. 3.)

V. Generation of the Patient's Thromboplastin

Individual substitutions in a TG tube are made of the patient's alumina plasma, the patient's serum, and when indicated, the patient's platelet suspension. The per cent thromboplastin generated at 6 minutes in these incubation mixtures can be read off the thromboplastin dilution curve. (Fig. III.) A rough quantitative measure can often be achieved by comparing the relative effects on thromboplastin formation of dilutions of normal and abnormal samples. For example, an approximate measure of the extent of deficiency can be obtained by carrying out the Thromboplastin Generation Test on a one in five or one in ten dilution of the patient's serum and comparing the resulting curve with a series of curves prepared using dilutions of normal serum. If a one in ten dilution of the patient's serum gives a curve similar to that of the one in one hundred dilution of normal serum, the patient's serum may be said to have 10% of the normal thromboplastin-forming capacity.

VI. Reagents

3.8% Sodium Citrate
0.85% NaCl
M/40 $CaCl_2$

Aluminum Hydroxide

Aluminium hydroxide prepared by the method of Bertho & Grassman. This is used for the adsorbtion of prothrombin and convertin from plasma. 100 ml of ammonia solution (sp. gr. 0.88 diluted 1:2) are poured into 600 ml of water at 63 degrees C., containing 22 grams of ammonium sulfate and the temperature is rapidly brought to 58 degrees C. The mixture is stirred vigorously and poured rapidly in one lot, into a solution of 76.7 grams of ammonium alum in 125-150 ml of water at 58 degrees C. The temperature rises to 61 degrees C. Stir for 10 minutes without letting the temperature fall below 58 degrees C, and then separate the precipitate by centrifuging. The precipitate is washed five times with 1500 ml of distilled water, separating the precipitate each time by centrifuging. To the first wash 0.44 ml of ammonia is added (sp. gr. 0.88 diluted 1:2). To the second wash water

.88 ml of the same ammonia solution is added before washing. The whole procedure should not take more than 5 hours. The precipitate is suspended in the least amount of water that is required to make a gelatinous suspension that can be pipetted. (We used just enough water to rinse the test tubes.) The addition of 1 to 4 ml of this suspension to 100 ml of plasma is usually sufficient to remove most prothrombin an convertin that is present. For each 2 ml of plasma we use, 0.2 ml of this $Al(OH)_3$ suspension.

VII. Preparation of Glassware and Needles

Silicon & Arquard treatment—See "Non-wettable Surfaces." Year book of Medicine 1953-54, page 243.

Summary

The Thromboplastin Generation Test has been described in detail. The preparation of some of the reagents and the platelet supension are time consuming but the test is technically simple. The Thromboplastin Generation Test is not required frequently in ordinary routine diagnosis but used in appropriate cases, it has inestimable value in pin-pointing the specific defect in Stage I of the clotting scheme. By using the Thromboplastin Generation Test, mild cases of hemophilia may be detected and diagnosed or they may be differentiated from Christmas and Rosenthal diseases. This is of practical importance since the treatment of these diseases differs and fresh blood is required only for classic hemophilia.

The Thromboplastin Generation Test is of value in diagnosing platelet dysfunction (Thromboasthenia). It also offers confirmation of the presence of a circulating anticoagulant of the antithromboplastin variety.

Acknowledgment

The author wishes to thank Sylvia MacIntyre, M.T. (ASCP) and Jean Jones for their technical assistance, to thank Dr. J. N. Patterson, senior member of Drs. Mills, Patterson & Leonard Laboratory, Tampa, Florida, for his advice and interest in this work, and to thank Fannie Sutherland for typing this manuscript.

BIBLIOGRAPHY

1. Biggs, R., Douglas, A. S., J. Clinical Pathology, Vol. 6, No. 1 (Feb., 1953), British Medical Journal.
2. Biggs, R., MacFarlane, R. G., (1953) Human Blood Coagulation and Its Disorders.
3. Biggs, R., Douglas, A. S. and MacFarlane, R. G., The Formation of Thromboplastin in Human Blood, J. Physol. 119:89 (1953).
4. Tocantins, L., The Coagulation of Blood, Grune & Stratton.
5. Bertho, A. & Grassmann, W., Laboratory Methods of Biochemistry, London MacMillan (1938).
6. Year Book of Medicine 1953-54, page 243, "Non-Wettable Surfaces."
7. Patterson, J. N., Monograph on Clotting, Med. Tech. Workshop, Univ. of Florida (August, 1954).

URINALYSIS—A SURVEY OF CURRENT PRACTICES*

By MARION H. COOK, B.S., M.T. (A.S.C.P.)
Miles-Ames Research Laboratory, Elkhart, Indiana

INTRODUCTION

A survey on urinalysis was carried out as a function of the Research Committee of the Indiana Society of Medical Technologists. The Research Committee tries to be of service to the medical technologists in the state. During the past year the committee thought it could be most useful by carrying out this urinalysis survey. The information was most interesting to us and we thought that medical technologists outside of Indiana would be interested in it too.

Urinalysis is often treated as a stepchild in a clinical laboratory. The job of testing urines is often relegated as quickly as possible to the most inexperienced person in the laboratory, the latest member, or the newest student. It is possible then that urinalyses are not always given the care and attention that they should have. Urinalyses are important. Tests run on urines should be done carefully and accurately. The need for more careful work and better training in urinalysis has been emphasized by Dr. J. L. Arbogast.[1] In his analysis of Registry examination used for certification of medical technologists, he noted a general weakness in two fields. One of these fields was urine analysis.

History, according to H. W. Smith[2] records that the importance of urinalyses has been recognized for centuries. Babylonian physicians noted color and consistency of urine and observed whether sediment and blood were present. The ancient Hindu noted the occurrence of what they called "honey urine." The attraction of ants to the sweet urine came to be recognized as a means of diagnosis. This was undoubtedly one of the oldest reliable diagnostic tests. In the seventh century, Theophilus mentioned the application of heat as a diagnostic test, referring to the cloudiness caused by heating albuminous urine.

Urinalyses have changed tremendously through the years, increasing in importance and complexity. Now we are no longer limited to what the eye can see. There is the microscope to help find smaller elements. Various chemical reactions give additional information. Instruments go to work where human faculties fail.

GENERAL INFORMATION FROM SURVEY

Information on the current practices in urinalysis by Indiana technologists was obtained by means of a questionnaire sent out to all Indiana members of the American Society of Medical Technologists.

* Read before ASMT, June 1955, New Orleans, Louisiana.

Distribution of Laboratories. Questionnaires were returned from thirty-eight different laboratories. The locations of these laboratories are shown in Figure 1. The reporting laboratories are well distributed throughout the state. It would seem that data obtained from their questionnaires would be fairly representative of Indiana urinalysis practices.

Classification of Laboratories. These thirty-eight laboratories were classified as shown in Figure 2. As might be expected, most of the laboratories were in general hospitals.

Samples for Urinalysis. Figure 3 shows that most of the technologists (twenty-four out of thirty-eight reporting) run tests mainly on random urine samples. For quantitative chemical determinations, twenty-four hour urine specimens were requested. For Addis counts, four laboratories requested twenty-four hour specimens, six requested twelve hour specimens, and the remainder did not mention the test. Ten laboratories requested special samples as follows for Mosenthal test:

No. of Labs	Samples Requested
1	24 hr. specimen
1	Each voiding
1	Two quantities for two consecutive 12 hr. periods
1	A 12 hr. night specimen and five 2 hr. day specimens
1	Timed specimens
5	(Special sample but type not mentioned)

Six laboratories requested special samples as follows for P.S.P. test:

No. of Labs	Samples Requested
1	¼, 1 and 2 hr. specimens
1	15 and 30 minute specimens
1	1 and 2 hr. specimens
3	(Special sample but type not mentioned)

Nine laboratories stated that they requested special samples as follows for urobilinogen:

No. of Labs	Samples Requested
3	2—4 p.m. sample
1	12—2 p.m. sample
1	2 hr. sample
1	Fresh specimen
1	Not over 1 hr. old
2	Early morning sample

One laboratory requested an early morning specimen for Bence Jones protein test.

Use of Preservatives. Sixteen laboratories reported the use of preservatives during the collection of twelve or twenty-four hour urine samples. The preservatives used are shown in Figure 4.

DISTRIBUTION OF LABORATORIES REPORTING

Fig.1

CLASSIFICATION OF LABORATORIES REPORTING

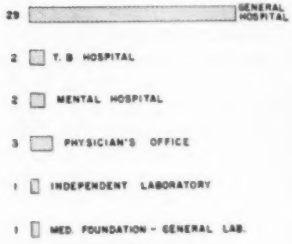


Fig.2

SAMPLES FOR URINALYSIS

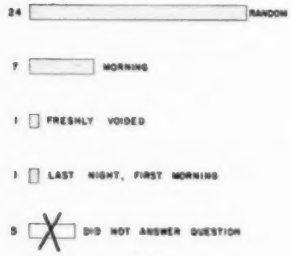


Fig.3

USE OF PRESERVATIVES

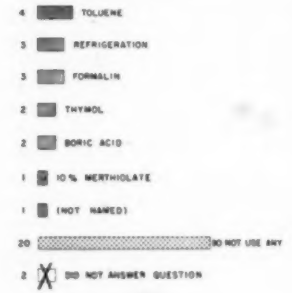


Fig.4

TESTS RUN IN WARDS

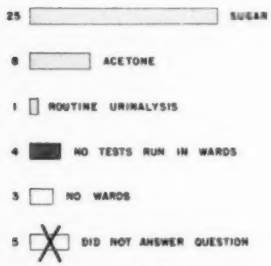


Fig.5

ROUTINE URINALYSIS

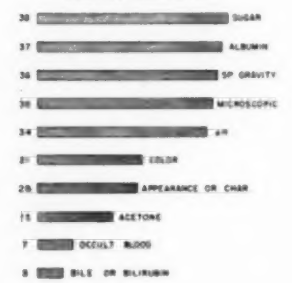


Fig.6

Tests Run on Wards. In some hospitals some of the simple routine tests are, at times, run on the ward instead of sending the urine to the laboratory. Figure 5 shows some of the tests which may be run in the wards.

Routine Urinalysis. In the questionnaire, laboratories were requested to list the tests constituting a "routine urinalysis" in their particular laboratory. Figure 6 lists the various tests mentioned and the number of laboratories which run that test as a part of a "routine urinalysis." In addition to those listed, one laboratory runs acetone tests on all pediatric urines, another laboratory includes Sulkowitch in their routine urinalysis, and a third laboratory routinely reports on the quantity of urine.

"IF" Tests. It is a usual procedure to run certain tests if some other test is positive or if the appearance of the urine itself suggests that test. All the "If" tests reported in the questionnaire are listed below: The most commonly reported ones are shown in Figure 7.

No. of Labs	Test Run	If
20	Acetone	Sugar positive
1	Acetone	Albumin high
14	Diacetic Acid	Acetone positive
6	Diacetic Acid	Sugar positive
4	Diacetic Acid	Sugar and acetone positive
15	Bile or Bilirubin	Color or foam suggests presence
1	Bile or Bilirubin	Urobilinogen positive
10	Urobilinogen	Bile positive
5	Bence Jones	Albumin positive, microscopic negative
3	Quant. Albumin	Qualitative high
2	Quant. Sugar	Qualitative high
2	Occult blood	Color suggests presence
2	Occult blood	Blood seen microscopically
1	Pentose	Sugar positive (not known diabetic)
1	NPN	Albumin high
1	Porphobilinogen	Highly colored

PHYSICAL APPEARANCE OF URINE

The physical appearance of urine is usually described by twenty-seven laboratories and not ordinarily described by ten others. (One lab did not answer the question.) The various aspects of physical appearance as described by the reporting laboratories are shown in Figure 8.

Color. The color is described by twenty-seven laboratories. The range of shades and colors defies tabulation. Terms used include colorless, pale, shades of straw, shades of yellow, shades of amber, and various abnormal colors such as brown, red, blue, and green.

Turbidity. Twenty-seven laboratories noted whether the urine was clear or cloudy. The number of grades of cloudiness or turbidity used to describe the urine are shown below:

No. of Labs	No. of Grades Described
2	1 grade only
10	2 grades
8	3 grades
1	4 grades
2	5 grades
4	Turbidity but terms not given

Odor. Only five laboratories make any note of the odor of the urine sample. One of these reported only the presence of an ammoniacal odor, three reported only if markedly unusual, and one notes whether it has a fecal, fruity, or ammoniacal odor. Thirty-three laboratories paid no attention to the odor.

pH or Reaction. Thirty-four laboratories report on the pH in various terms as shown below:

No. of Labs	Terms or Methods
8	Acid or alkaline
8	Nitrazine paper
7	Actual pH value (method not given)
3	Acid, neutral, alkaline
2	pH range paper
2	Brom thymol blue
1	Litmus paper
3	Determine reaction but method or values not given
2	Do not test reaction of urine

(2 laboratories did not answer the question.)

Specific Gravity. Thirty-five laboratories reported values as obtained by urinometers. Three laboratories did not answer the question.

MICROSCOPIC EXAMINATIONS

All thirty-eight laboratories performed microscopic examinations on urine. Three of these laboratories examined whole urine and thirty-five examined the sediment after centrifuging.

Stained Sediment. Twenty-seven laboratories do not examine stained sediment. Seven laboratories examined stained sediment but did not state the stain used. Thirteen laboratories did gram stain when requested; six did acid fast stains; one did a methylene blue stain; and one used a stain only when looking for fungi.

Red Cells and White Cells. All laboratories make some attempt to estimate the number of each type of cell present. There was probably more variation in the reporting of red and white blood cells than was noted for any other item in the whole urinalysis questionnaire. In general, however, each technologist classifies the number of cells into three groups as follows:

1. Occasional—cells not present in every high power field but are seen occasionally.
2. Countable—cells are present in every field. Cells are counted and the average number per high power field is reported.
3. Innumerable—each field contains so many cells that the technologist considers that there are too many to count.

How many cells does a technologist count before he considers that there are too many to count? In one laboratory they count to ten and then report in plusses. In another, they count to forty and then report in plusses. In other laboratories they count to 50, 60, 75, 100, 125, or in one case by counting a quarter of a field the technologist counts up to 250 cells per high power field before reporting "TMTC" or "innumerable" cells.

Casts. In reporting casts about half the laboratories report the number per low power field and about half report the number per high power field.

No. of Labs	Terms Used
17	Number per low power field
14	Number per high power field
2	Number per field (type not given)
3	Roughly quantitative (rare, occasional, etc.)
1	Only presence is noted

(1 laboratory did not answer the question.)

Epithelial Cells. Most of the technologists only roughly quantitate the epithelial cells present.

No. of Labs	Terms Used
17	Four grades
1	Six grades
5	Number per high power field
2	Number per low power field
3	Occasional or many
3	Only presence is noted
7	Do not report if seen

Threads.

17 laboratories report only their presence.
14 laboratories report somewhat quantitatively.
6 laboratories do not report if seen.
(1 laboratory did not answer the question.)

Bacteria.

17 laboratories report only their presence.
14 laboratories report somewhat quantitatively.
2 laboratories report only if seen in catheterized specimen.
1 laboratory reports only if moderate amount present.
4 laboratories do not report if seen.

Yeast.
29 laboratories report only their presence.
7 laboratories report somewhat quantitatively.
2 laboratories do not report if seen.

Fat.
18 laboratories report only its presence.
4 laboratories report somewhat quantitatively.
11 laboratories do not report if seen.
(5 laboratories did not answer the question.)

Crystals.
16 laboratories report only their presence.
17 laboratories report somewhat quantitatively.
15 laboratories try to identify crystals.
2 laboratories report only sulfa crystals.
1 laboratory does not report if seen.
(1 laboratory did not answer the question.)

Spermatazoa.
21 laboratories report only as present.
8 laboratories report somewhat quantitatively.
7 laboratories do not report if seen.
(2 laboratories did not answer the question.)

Parasites.
22 laboratories report only as present.
14 laboratories report somewhat quantitatively.
6 laboratories try to identify type of parasite.
1 laboratory does not report if seen.
(1 laboratory did not answer the question.)

CHEMICAL EXAMINATION OF URINE

In testing for a particular compound, a single laboratory frequently reports the use of more than one method. In several cases, therefore, the total number of tests adds up to more than the total laboratories reporting. The various methods employed in the thirty-eight Indiana laboratories have been tabulated in this section.

Sugar—Reducing Substances. Figure 9 shows the various sugar tests used. Only a few different methods have been reported by all laboratories.

Sugar—Fermentation Tests. Only eight laboratories reported that they occasionally run fermentation tests.

Sugar—Pentoses. Six laboratories report that they run tests for pentose. Two laboratories use Tauber, three use Bial, and the other laboratory did not mention the method used.

Sugar—Lactose. Seven laboratories report the use of tests for lactose. Three of these use a fermentation test, two use Rubers, and the other two did not state the method used.

Sugar—Galactose. Only one laboratory said they tested for galactose. This laboratory used a mucic acid test.

"IF" TESTS

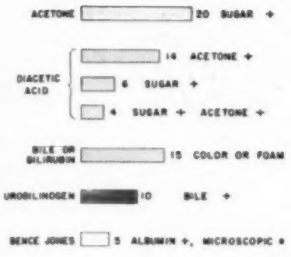


Fig.7

PHYSICAL APPEARANCE

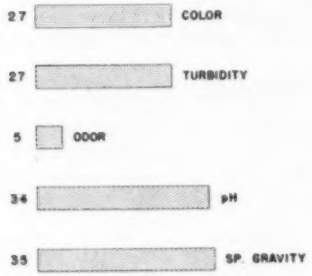


Fig.8

SUGAR - REDUCING SUBSTANCES

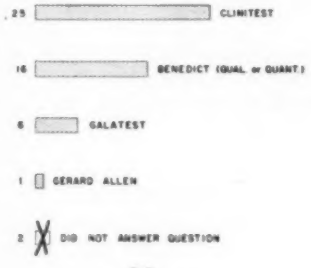


Fig.9

ACETONE

Fig.10

QUALITATIVE PROTEIN

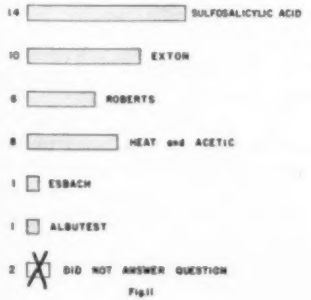


Fig.11

QUANTITATIVE PROTEIN

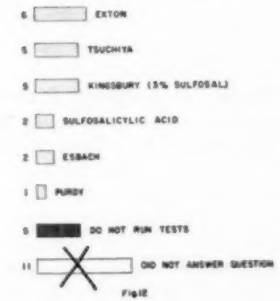


Fig.12

Acetone. The use of various acetone tests are shown in Figure 10.

Diacetic Acid. The various methods reported for testing urine for diacetic acid are listed below:

No. of Labs	Test Used
15	Gerhardt
6	Lindemann
3	Ferric chloride
2	Iodine—chloroform
1	Lugol's iodine
1	Langes
3	Methods not given

4 laboratories do not run tests.
(5 laboratories did not answer the question.)

Qualitative Protein. The method used by the various laboratories for qualitative testing for protein are shown in Figure 11.

Quantitative Protein. Figure 12 shows the various tests reported by the Indiana laboratories for the quantitative determination of protein.

Bile or Bilirubin. The various tests used for the detection of bile or bilirubin are shown graphically in Figure 13.

Chloride. The various methods used for chloride determinations are listed below:

No. of Labs	Test Used
6	Fantus
4	Schales
2	Volhard
1	Volhard-Harvey
1	Marriott
1	Whitehorn
1	Sendroy
1	Wilson & Ball
8	Method not given

7 laboratories do not run the test.
(7 laboratories did not answer the question.)

Blood. The various methods used for the detection of occult blood are shown in Figure 14.

Diastase. Only eight of the laboratories reported the use of a diastase test. Four of these laboratories use Somogyi test and four did not state the test used. Twenty laboratories said they did not run diastase tests. Ten laboratories did not answer the question.

Calcium. The methods reportedly used for the determination of calcium are shown below:

No. of Labs	Test Used
20	Sulkowitch
1	Roe and Kann
1	Tsuchays
3	Method not given

8 laboratories do not run the test.
(6 laboratories did not answer the question.)

Urea. The various methods used for urea determinations are given below:

No. of Labs	Test Used
2	Urease
2	Diacetyl monoxime
1	Gentzkow
1	Hench and Aldrich
1	Folin Wu
2	Karr
1	Scott
1	Van Slyke & Cullen
1	Hypobromite
1	Colorimetric
5	Method not given

10 laboratories do not run the test.
(10 laboratories did not answer the question.)

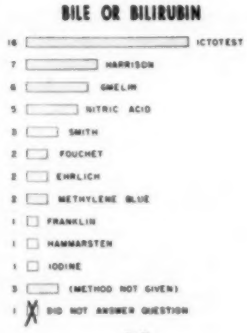


Fig 13

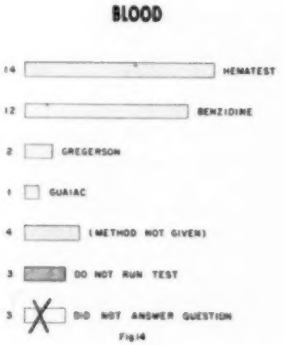


Fig 14

Urobilinogen. The following methods were reported used in testing for urobilinogen:

No. of Labs	Test Used
18	Ehrlich
6	Watson
3	Wallace Diamond
3	Method not given

6 laboratories do not run the test.
(4 laboratories did not answer the question.)

Melanin. Methods used for detection of melanin are as follows:

No. of Labs	Method Used
10	Ferric chloride
1	Bromine water
1	Blackberg & Wanger
1	Sunlight
4	Method not given

12 laboratories do not run test.
(10 laboratories did not answer the question.)

DISCUSSION

We are fully aware of the fact that Indiana is only one state in the union and that this group of thirty-eight laboratories represents a very small segment of all the clinical laboratories. We still feel that the data presented are very important. It is entirely possible that results of this survey actually mirror a wider picture of urinalysis procedures than would appear at first glance. We feel that our data are of interest not only to Indiana technologist but also to technologists throughout the country.

SUMMARY

Urinalysis data were obtained from questionnaires sent out to Indiana members of the American Society of Medical Technologists. Using this information, the current practices of thirty-eight different laboratories have been tabulated. For certain examinations of urine only a few methods are reported by all laboratories. For other examinations there are almost as many different methods as there are laboratories reporting. The methods have been tabulated as reported in the urinalysis questionnaire, accepting the statements as given.

REFERENCES

1. Arbogast, J. L.: Certification of medical technologists. Results of examination given by the registry in October 1952. Technical Bulletin 24: 229-236, 1954.
2. Smith, H. W.: De Urina. Journal American Medical Association 155: 899-902, 1954.

THE GAVEL

Louisiana's Medical Technology Week, so graciously proclaimed by Governor Robert Kennon, was not only a history making event, but a fitting tribute to the members who worked so diligently to present our twenty-third annual session.

In taking over as presiding officer, I would like to express my sincere gratitude to those responsible for the most efficient progress made by our society in this past year as can be noted in your June Newsrelease.

Right now we are depending on each of you to bring to the attention of your Congressmen our request for a SILVER ANNIVERSARY Commemorative Stamp. To continue toward the realization of the purposes set forth in our By-Laws, the standing committees, with new members added, have agreed to serve you in their respective capacities. Newly elected members have joined the Board of Directors and they, too, are ready and willing to give all possible assistance in bringing mutual aid to you, the members of our professional society.

Barbara Isbell, M.T. (ASCP)
President

AMONG THE NEW BOOKS

IONOGRAPHY Electrophoresis in Stabilized Media. by Hugh J. McDonald. The Year Book Publishers, Inc., 1955. 268 pp. $6.50.

As explained in the section on terminology, p25, McDonald suggests the term "ionography" (meaning literally "the recording of a wanderer") as a convenient one to describe the electromigration of all types of migrants—colloidal materials such as proteins, as well as ionic species, whether inorganic or organic, in stabilized media whether paper, starch, agar, etc. He feels it is more generally useful than the other terms such as ionic migration, paper electrophoresis, paper ionophoresis, electrochromatography, zone electrophoresis, which have been used to describe the same or closely allied techniques. In the clinical applications of the technique, separation of serum and cerebrospinal fluid proteins and of abnormal hemoglobins, however, the term paper electrophoresis is more familiar to most of us.

This book should be very useful to anyone using these techniques or contemplating setting them up. It has an up-to-date bibliography containing 760 references. Besides the separation of proteins, techniques are discussed for the separation of carbohydrates, nucleic acids, enzymes, hormones, vitamins, and inorganic substances.

Esther Freier

FROM THE KNICKERBOCKER FOUNDATION, INC.

We would like to extend an invitation to all the readers of the American Journal of Medical Technology to make use of the Knickerbocker Foundation facilities for antibody studies.

We are particularly interested in doing serological studies for blood antibodies—for Rh, Hr, Kell, Duffy, Kidd, S, M, N. Lewis, and so on. We will be pleased to receive specimens causing transfusion reactions or related to problems of "incompatible" pregnancy and hemolytic blood disorders. Should you have any cases in these categories may we suggest that blood clots to which a few drops of penicillin have been added as a preservative be sent to us? We will run our tests and submit a report immediately.

This work is all done free of charge, financed by the general funds of the Foundation.

We are looking forward to the privilege of helping you in this important work.

AWARDS

Presented at Convention, New Orleans, La., June, 1955

1955 Scientific Products Foundation

IN SEROLOGY

1st **Presumptive False Positive Serologic Reactions for Syphilis In Central America**—by Genevieve Stout, MT (ASCP)
2nd **The Role of Calcium Salt In the Kolmer Complement Fixation Test for Syphilis**—by Eleanor Stackhous, MT (ASCP)
3rd **The Role of the State Laboratory In Statewide Improvement and Standardization of Syphilis Serology**—by Genevieve Stout, MT (ASCP)

IN HEMATOLOGY

1st **Observations of the Lipoid Granulation of Cells of Human Blood and Bone Morrow by Means of Sudan Black B Staining Techniques**—by Kathryn Grave, MT (ASCP)
2nd **Erythrophagocytosis In Hemolytic Disease of the Newborn**—by Mary B. Cooper, MT (ASCP)
3rd **The Value of the Hematocrit As a Laboratory Determination**—by Margaret Brown, MT (ASCP)

IN BIOCHEMISTRY

1st **Experience with the Reddy Method for—17-Hydroxycorticoids In Urine In a Clinical Chemistry Laboratory**—by Kathleen Clayson MT (ASCP)

TIED FOR

2nd **A Comparative Study of Precipitation Time and Temperature Factors Affecting Blood and Urine Calcium**—by Bernice Elert MT (ASCP)

AND

Amperometric Titration of Chloride In Tissue, Serum, Urine and Feces—by Ben Earl Halloway, MT (ASCP)

IN BACTERIOLOGY

1st **Blood Media for the Cultivation of Mycobacterium Tuberculosis**—by Wayne A. Stenback
2nd **A Simplified Sensitivity Procedure for Anaerobic Micro-organisms**—by John Alvarez, MT (ASCP)
3rd **Bacillary Dysentery with Bacteremia**—by Margaret Henson, MT (ASCP)

IN BLOOD BANKING & BLOOD TYPING

1st **Cross Matching the Uncrossmatchable Recipient**—by Jane F. Taylor, MT (ASCP)
2nd **Elution Technic for Identification of Antibody-Coated Erythrocytes**—by Hannah Pretshold, MT (ASCP)
3rd **Preparation of Anti-A_1 (Absorbed B) Serum A Simplified and Inexpensive Technic**—by Hannah Pretshold, MT (ASCP)

IN EDUCATION & PROCEDURAL TECHNIQUES

1st **Flame Photometry In the Clinical Laboratory**—by Ann Carol Unseth
2nd **Tests of Pulmonary Function**—by Grace Paul, MT (ASCP)
3rd **A Program of Refresher Training from the Point of View of Georgia Society of Medical Technologists**—by Carolyn Martin, MT (ASCP)

Hillkowitz Award

Experience with the Reddy Method for 17-Hydroxycorticoids In Urine In a Clinical Chemistry Laboratory—by Kathleen Clayson, MT (ASCP)

Registry Award

Amperometric Titration of Chloride In Tissue, Serum, Urine and Feces—by Ben E. Hallaway, MT (ASCP)

ASMT Convention Awards—Papers

1st **Cross Matching the Uncross-Matchable Recipient**—by Jane F. Taylor, MT (ASCP)
2nd **A Simplified Sensitivity Procedure for Anaerobic Micro-organisms**—by John P. Alvarez, MT (ASCP)
3rd **A Flame Photometric Method for Calcium Determination By Direct Serum Dilution and Comparison With the Permanganate Titration Method**—by Bernice Elert, MT (ASCP)

Exhibits

Activities In the Tennessee Society of Medical Technologists—Tenn. S.M.T.
Enteric Bacteriology—by Lucille Godelfer, MT (ASCP) and George H. Hauser, M.D.

American Journal of Medical Technology—Publication Awards

The Funnel—Indiana Society of Medical Technologists, Jane Greer, MT (ASCP), Editor
The Bulletin of the Ohio Society of Medical Technologists, Adah Ruth Sutton, MT (ASCP), Editor

PHOTOGRAPHY CONTEST—Sponsored by the Public Relations Committee

The library of photographs of Medical Technologists at work was markedly advanced this year with the addition of the fine quality examples shown.

First prize award, National Photo Contest sponsored by the American Society of Medical Technologists. Photo was submitted by Marianne Schaaf, M.T. (ASCP), (extreme right in picture), director of medical technology, Marquette University School of Medicine, Milwaukee, Wisconsin. Photo was taken by Anthony M. Kuzma, chief photographer, department of pathology, Marquette University School of Medicine. Contest was open to medical technologists in 48 states, Hawaii and Puerto Rico. Winning entries stressed the Society theme: "Educated Minds and Trained Hands Ready to Serve Humanity."

(above)
Second prize award in National Photo Contest sponsored by the American Society of Medical Technologists. Photo shows medical technologist preparing bacteriological specimen in laboratory prior to diagnosis. This award was presented to Cleola M. Wurth, M.T. (ASCP), St. Mary's Hospital, Decatur, Illinois, at national convention of the society at the Jung Hotel, New Orleans, La., on June 14, 1955.

Judging the best photos in the photographic contest sponsored by the American Society of Medical Technologists are Mrs. Ellen Skirmont Diffenbaugh, M.T. (ASCP), photo contest chairman; Rudolph J. Guttosch, of Kranzten Studio, Evanston, Illinois, and Eugene I. Stein, president, Kaufmann & Fabry Co., Inc., Commercial photographers, Chicago. The awards were presented at the annual convention in New Orleans.

Beside winning the second award, Miss Wurth had three honorable mention photographs. (See next page for two of these.) Honorable mention for black and white photos also went to Sister Hilda of St. Francis Hospital, Evanston, Ill., and to Betty Jean Heim, Espanola Hospital, Espanola, New Mexico.

Special mention award to Sister Lucia Herr, St. Anthony's Hospital, Hays, Kansas, for a picture story.

For Kodachromes Mrs. Aileen Wright, 328 Sandusky St., Jacksonville, Illinois, won first and second awards and an honorable mention. Ruth Fox, Essex City Sanitarium, Verona, New Jersey, won this third award and two honorable mentions. Nellie Bering, 1332 31st St., N.W., Washington, D. C., won two honorable mentions with her kodachromes.

(Left) Third Prize award in Photo Contest sponsored by the American Society of Medical Technologists is won by Sister St. Francis, RHSJ, (right), St. Bernard's Hospital, Chicago, Illinois. Photographer was Dave Schuessler Studios, Chicago.

The theme of "Educated Minds and Trained Hands" carried throughout the photography contest shows in honorable mention pictures of and by Betty Jean Heim (upper left), the picture of Wendell Cantwell, medical technologist, demonstrating how blood is marked and stored in the refrigerator blood bank to Student Carol Hawkins, in the photograph submitted by Sister Hilda (lower left), and two of the three winners by Cleola Wurth (upper and lower right).

CONVENTION PROGRAM—Apologies are due to Difco Laboratories which has so generously underwritten our annual programs for many years. We inadvertently omitted this credit line on the convention program.